

FEBRUARY, 1955

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METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

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The Use of Filters in Electroplating

Why, Where, and How to Filter

Alkali Metals in Phosphating and Cyanide Plating Baths

Determination by Means of Anion Exchangers

Anodizing Hollow Objects

Bipolar Electrodes Provide Effective Method

Metal Cleaning with Ultrasonics

Vibrational Energy for Improved Cleaning Action

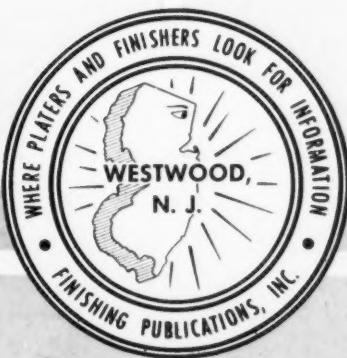
Descaling and Pickling Titanium

Research Discloses Satisfactory Processes

Surface Treatment and Finishing of Light Metals

Chemical Conversion Coatings for Aluminum

Complete Contents Page 49



READ & PASS ON

A CLEPO Compound

A Soak Cleaner for the
REMOVAL OF BUFFING COMPOUNDS
from BRASS Also recommended for
ALUMINUM - COPPER - NICKEL SILVER - STEEL

CLEPO 77-B

- ★ Rapid and thorough in action. Does not tarnish. Brass, Copper, Etc., on prolonged soaking.
- ★ No dry-out stains.
- ★ Can be used without agitation in many cases.
- ★ Easily rinsed.
- ★ Contains no soap.
- ★ Can be used in any water.

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ENTHONE has developed 8 outstanding metal strippers which, without attacking your base metal in any way, quickly and economically strip off defective plated coatings, excess solder, silver brazing metal, and metal smuts.

Where your
base metal is . . .

and you want to strip nickel, copper, silver, zinc or cadmium chemically, use

ENSTRIP "S", an additive for sodium cyanide solutions, or . . .

ENSTRIP "A", which is a prepared compound containing sodium cyanide.

where you want to remove copper or nickel coatings electrolytically, use

ENSTRIP 103, an economical alkaline electrolytic stripper containing no cyanide.

COPPER
or
STEEL

and you wish to dissolve tin, lead, or tin-lead coatings chemically, use

ENSTRIP "TL", a fast acting, alkaline stripper.

ALUMINUM,
COPPER
or
STEEL

and you want to take off heavy chromium coatings chemically, use

ENSTRIP "CR-5", a rapid, acid type stripper.

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ALLOYS

use ENSTRIP "165-S", an additive for acid solutions that will give you quick removal of nickel, tin, zinc, lead or cadmium.

ZINC
DIE
CASTINGS

use ENSTRIP "L-88", an acid electrolytic stripper for removing chromium, nickel or copper coatings.

Write directly to Enthon Inc., or to your nearest Enthon Service Representative, for further information.

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to help you



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Tell us which job gives you trouble (or circle the corresponding number in the coupon). We'll give you information about the new material that does the work, also send you our 44-page illustrated booklet "Some good things to know about Metal Cleaning."

Oakite chemists have developed efficient new materials for the seven important jobs listed below. One of these new materials may provide the perfect solution for your most difficult problem.

- 1 HEAVY-DUTY CLEANING IN TANKS:** New material combines the best qualities of alkaline and solvent cleaners.
- 2 CLEANING ALUMINUM IN SPRAY-WASHING MACHINES:** Safe cleaning with minimum foaming whether spray pressure is high or low.
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- 5 ELECTROCLEANING BRASS:** Efficient, economical cleaning without danger of tarnish.
- 6 INHIBITING PICKLE BATHS:** Liquid inhibitor for sulphuric, hydrochloric and phosphoric acids. Saves steel, saves acid, builds own foam blanket to suppress pickling fumes. Easy to add to continuous strip or batch pickling operations.
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1 2 3 4 5 6 7

Name. _____

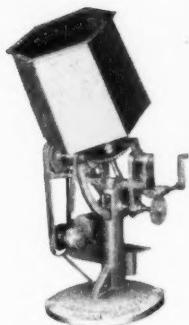
Company. _____

Address. _____

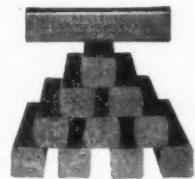
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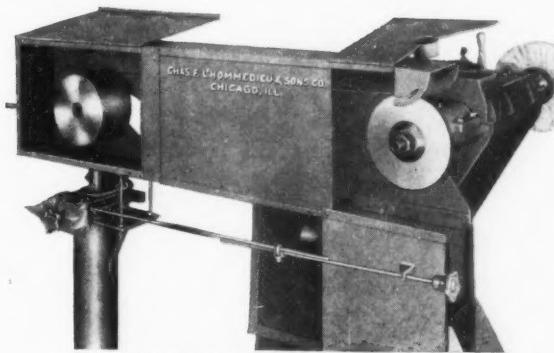
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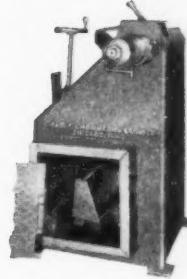
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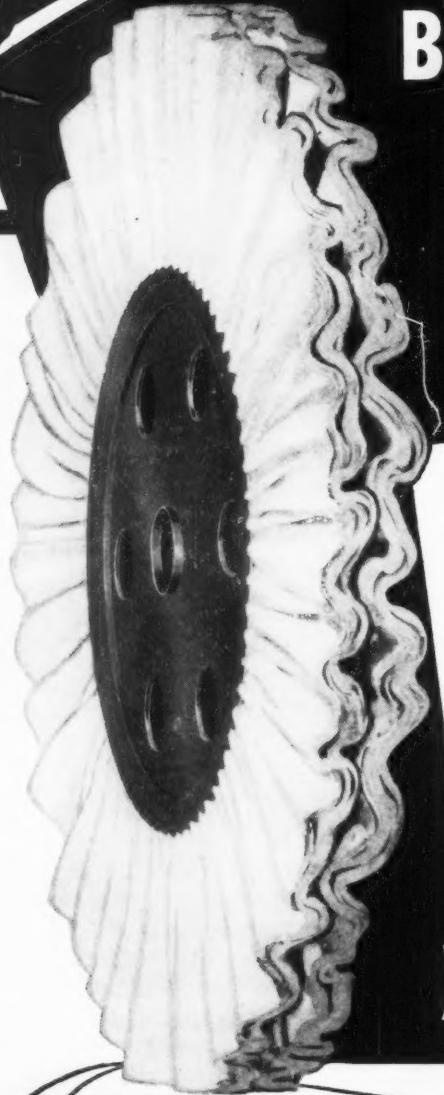
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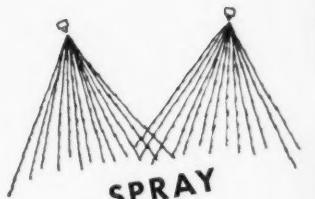
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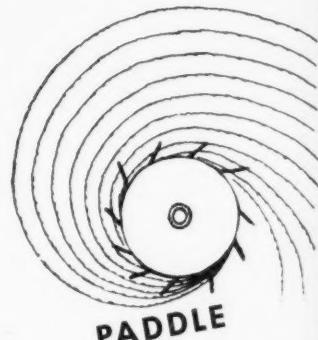
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SCHAFFNER AIR-COOLED METAL-CENTER BUFFS ARE PRICED RIGHT • PRODUCED IN ALL DIAMETERS, CENTERS, PLYS AND COUNTS

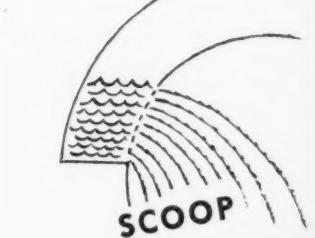
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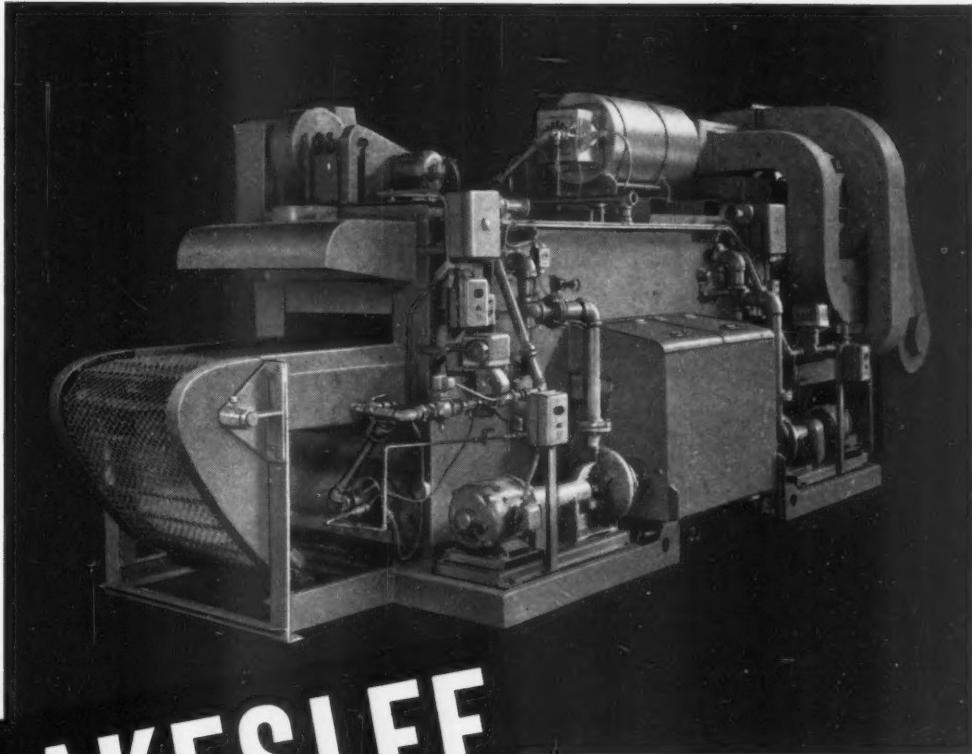
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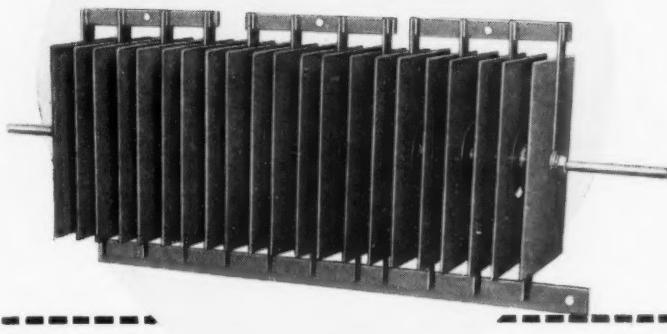
Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N.Y. Simonds Canada Saw Co. Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

Six Square

Inches per

Ampere* of

"Heart"!



The New, Revolutionary
RAPID GERMANIUM RECTIFIER
Is Now In Production!
Look for Details Here Next Month

The selenium stack is the heart of any selenium rectifier. For it is the quality of the stack and its accompanying circuitry that determines the effectiveness of a rectifier, just as the state of the heart and blood vessels of a human determine his strength and health.

IT'S A PROVEN FACT, RAPID RECTIFIER STACKS STAND UP LONGER IN HARD SERVICE. HERE'S WHY:

- 1) Rapid allows 6 square inches per ampere of plate surface in full wave bridge circuits. For years we have maintained this standard (somewhat higher than other makes), since we feel allowing this much area results in maximum life expectancy.
- 2) The plates in Rapid stacks use triple purified Selenium.
- 3) They are carefully tested and balanced for even current distribution.
- 4) They are coated with an exclusive material rendering them absolutely impervious to the corrosive conditions existing in plating rooms.
- 5) The plates are spaced an average of $\frac{1}{2}$ inch, diminishing the possibility of dust, dirt and corrosive material becoming lodged between plates, thus allowing heat to dissipate readily.

Rapid designs its stacks to much higher standards than most other manufacturers. **

For example:

In tests performed at ambient temperatures of over 30°C , a recognized electrical manufacturers' group standard allows a temperature rise in the stack of 60°C ; and, a rise of 40°C at the same ambient temperature for 1000 hours is permitted without derating.

Rapid standards permit a maximum stack temperature rise of only 22°C above the ambient. This low rise is made possible only because of the large area used per ampere, the plate spacing, high purity of Selenium used, the advanced circuitry and the engineering skill which designs the complete rectifier unit for the specific job.

So, when you buy a rectifier, check its heart. Make sure the one you buy offers the most advanced design for longest life . . . In other words, make sure you get a Rapid Rectifier.

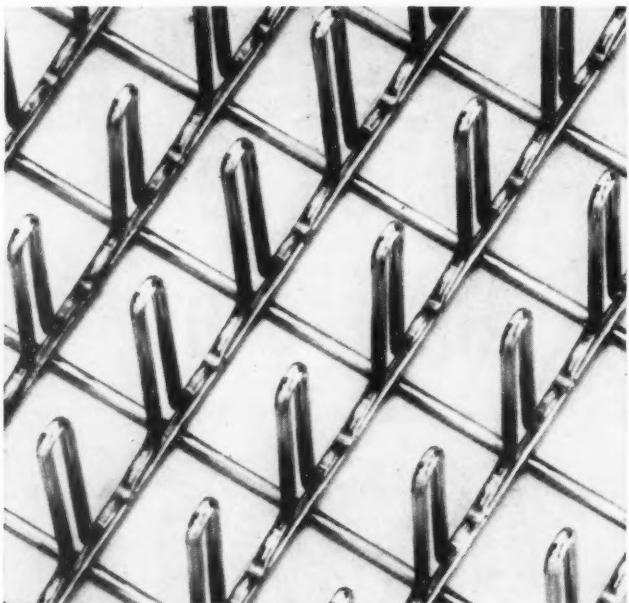
*In forced air cooled, three phase, full wave bridge circuit units.

**All three phase rectifiers are designed with a full wave circuit.

THE NAMEPLATE THAT MEANS "More Power to You!"

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Photograph of dish drainer basket plated in ordinary chromium solution. Dark areas at base of wire fingers show no coverage of nickel.



Same product when plated in SRHS Chromium Solution. Note the even color at top and base of finger — evidence of complete coverage.

Making the most of Quality to cut your plating costs?

United Chromium points out ways to reduce expenses in the coating of metals

AT FIRST THOUGHT, "quality" seems to imply high cost. However, in a production operation like plating, quality doesn't have to cost more — it can save. Here are some specific cases showing how:

SAVE WITH HIGHER QUALITY CHROMIUM PLATING

It's easy to recognize a top grade chromium finish. It's bright, with no grey or rainbow plate, no burns or misses — and the deposit meets thickness specifications. The benefits of such quality plating are obvious: fewer rejects or costly reruns.

This is the kind of quality being obtained with Unichrome SRHS Chromium Plating Solutions. Having wider bright plate range than ordinary solutions, SRHS covers even difficult parts with a bright deposit. Higher speed of these solutions cuts plating time up to half for a specified thickness. Also, important constituents of the baths are self regulated to maintain optimum plating balance.

In hard plating operations, the leveling action of SRHS Chromium Solutions cuts grinding and polishing requirements, too — saving still more finishing time. In short, while turning out a quality job, SRHS also saves hours, work and headaches.

UNDERCOATS WITH QUALITY TO MATCH

Copper and Nickel plating not only contribute to the quality of the final chromium finish, but also affect the economy of the entire cycle of operation. Quality and economy are both benefited by a cycle of plating processes which are matched to each other.

Unichrome Bright Nickel, for instance, provides greater receptivity for the subsequent chromium. Passivity problems and activating treatments are avoided. Moreover, since this bath has proved exceptionally tolerant to impurities, it produces more flawless work with fewer purification treatments. Obviously, a process which can keep up a pace of untroubled production cuts operating expense.

Unichrome Pyrophosphate Copper constitutes

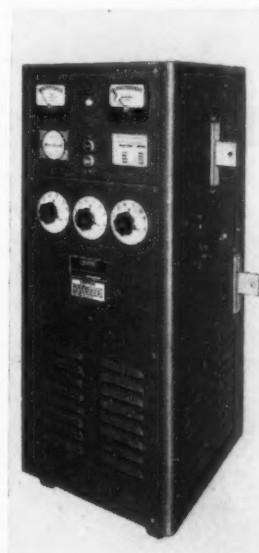
the other member of this matched finishing cycle. It plates quality deposits of such smoothness that buffing of copper or subsequent nickel is minimized or eliminated. One plant was in this way able to cut out 98% of the need for buffing nickel, thereby saving 48 man-hours of buffing labor daily.

QUALITY EQUIPMENT COSTS LESS PER YEAR

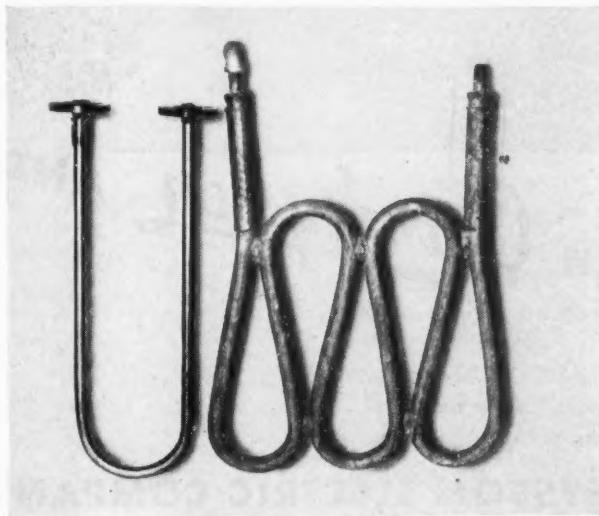
Production equipment plays a big part in production cost. The actual cost depends on how efficient the equipment is, how well it stands up, and how much time and effort it can save. In other words, it depends on quality.

Thus, Unichrome Rectifiers are built with the quality for money saving performance in plating and anodizing. They're unusual in stack design, transformer ratings, wiring, insulation details and other features — to give long, economical service at high efficiency.

As another example, Unichrome Tantalum Coils and Heat Exchangers represent the finest equipment of their kind for use in acid plating



Unichrome Rectifiers contain quality features that make them outstanding sources of low cost power for plating and anodizing. Shown here is a self-contained unit which includes the basic rectifier, meters, starter and controllers — all completely wired and ready for operation.



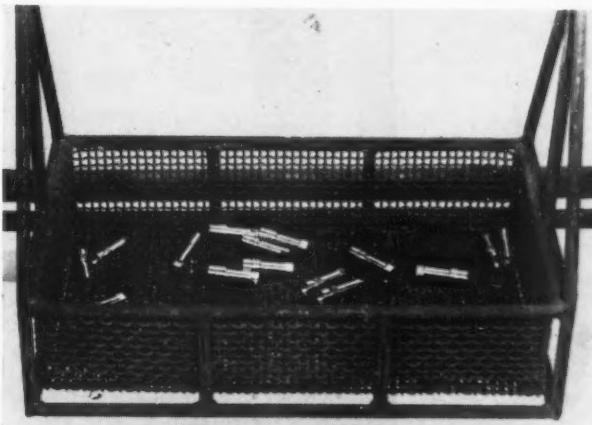
Simple, short hairpin Unichrome Tantalum Coil at left does better heating job in chromium plating bath than bulkier lead coil at right.

solutions — chromium in particular. Because they are acidproof, they maintain heat transfer efficiency and can last indefinitely. At one plant, a Unichrome Tantalum Coil was inspected after four hard years of chromium plating service and found still like new. In another case, the coils' quality helped pay for the installation within months by eliminating downtime and production loss formerly experienced with lead coils.

THE QUALITY RACK COATING

Racks represent some of the hardest working equipment in the plating shop. Coatings which have the quality to keep up with these "tools" without peeling, cracking or blistering can help reduce dragout losses, drag-in contamination, and rack maintenance expense.

Unichrome Coating 218X, a green plastisol compound and a familiar sight in many of the most cost-conscious plants, withstands all plating and cleaning cycles — even those including vapor degreasing. In some cases, the coatings have actually outlasted the racks themselves.



Quality of the familiar green Unichrome Coating 218X is so well known today that it is being used to save maintenance on equipment other than racks. Here is a dipping basket where Plastisol Coating 218X protects the work from scratches and withstands degreasing and cleaning cycles.



Because quality pays off in plating, it will pay you to get the details on the complete high quality Unichrome line of processes, equipment and materials. Contact the office of United Chromium nearest you.

UNITED CHROMIUM, INCORPORATED

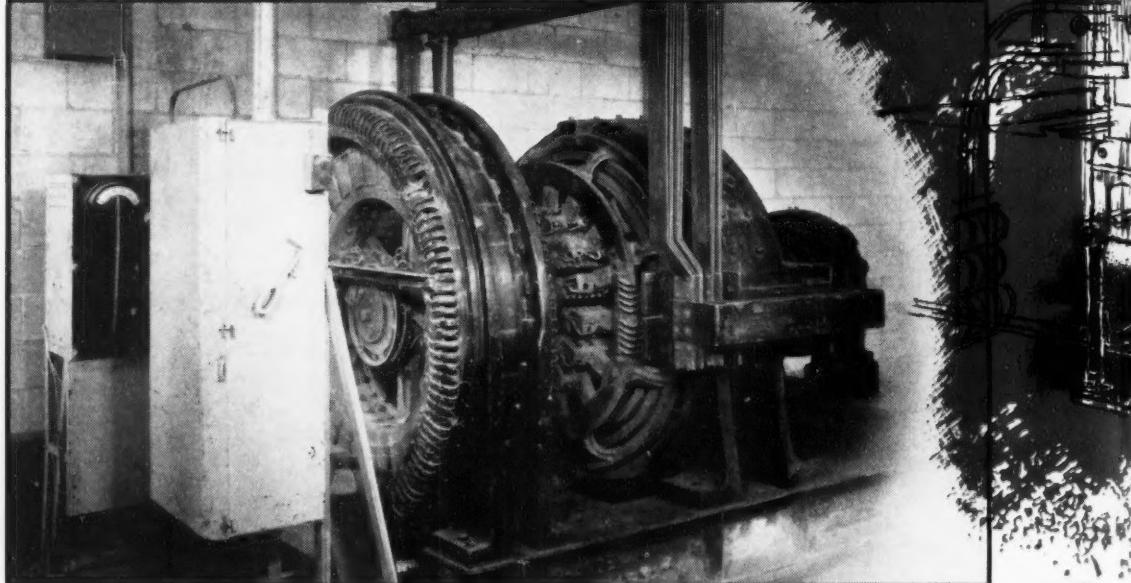
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**EXAMPLE: 'ROUND-THE-CLOCK
AT DiSALLE PLATING**



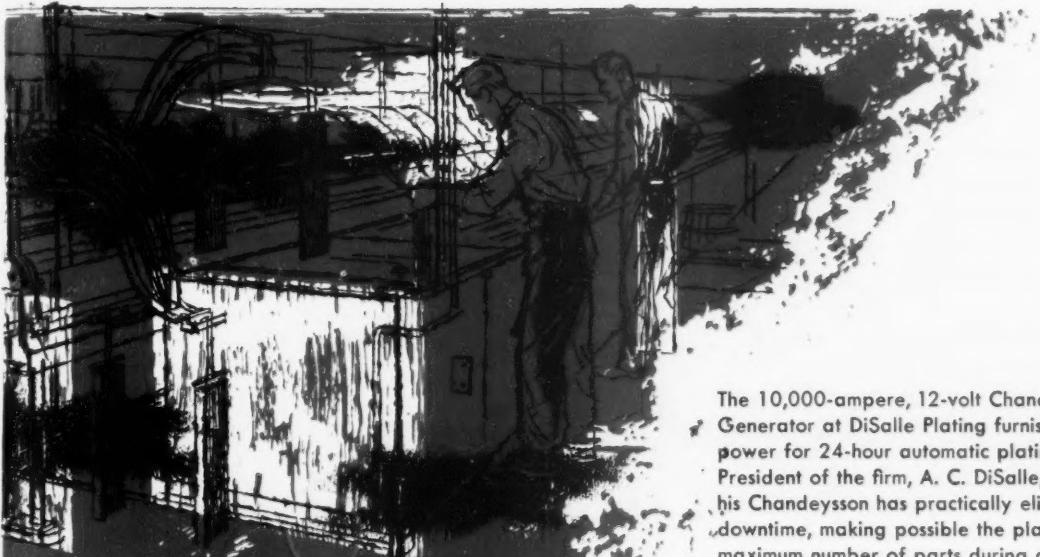
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The 10,000-ampere, 12-volt Chandeysson Motor Generator at DiSalle Plating furnishes dependable power for 24-hour automatic plating operation. President of the firm, A. C. DiSalle, reports that his Chandeysson has practically eliminated downtime, making possible the plating of the maximum number of parts during a 24-hour period.

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AWAYS...**

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precision-built for efficiency and built-in voltage regulation.

GET MORE OUT OF THE POWER YOU PAY FOR...

built-in high power factor at no extra cost.

BE SURE OF POWER WHEN YOU NEED IT MOST...

overload capacity as great as 50% momentarily and 25% sustained, without distress or damage.

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(Trichlorethylene)

"We're getting cleaner parts . . . extended operating time between cleanouts . . . reduced maintenance costs . . . effective recovery of stabilizers during normal distillation."

—Small Parts Mfr., West Coast

"In cleaning small aluminum, silver, copper alloy and zinc and stainless steel parts . . . cleanout time of degreaser and still has been cut by one third."

—Appliance Mfr., Indiana

"Degreased parts are brighter and cleaner. Chemical control of solvent greatly simplified and . . . we have peace of mind."

—Airplane Producer, Los Angeles

"Fine, consistent performance. Both aluminum and brass parts are brighter. We've increased operating period between cleanouts by about 25 per cent."

—Parts Mfr., Mass.

Du Pont's vapor degreasing solvent gives you brighter, better cleaning of all metals

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these
extras

EXTRA DURABILITY. New "Triclene" D has unsurpassed resistance to *all* major causes of solvent breakdown—heat, light, air, light metal chlorides, and acidic materials. It retains its original ruggedness even after repeated use and distillation.

EXTRA OPERATING ECONOMY. You get safe, thorough cleaning with new "Triclene" D. Rejects are not a problem . . . cleanouts are quicker and easier.

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All these extras add up to the finest solvent ever produced for vapor degreasing—new, all-purpose "Triclene" D. Let us tell you more about it. Just fill out and mail coupon below.

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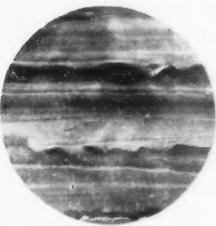
Battelle

Electropolishing and electrodeburring

what will it do?

here you see for yourself...

A 10,000-times-magnified steel surface cut up by abrasive polishing. Next you see it burnished, with slight improvement; and then the smooth, lasting beauty of the same surface electropolished.



FROM THIS . . .
(ABRASIVE POLISHED)
like a ploughed up field



YOU GET THIS
(BURNISHED)
slightly improved



. . . OR THIS
(BATTELLE ELECTROPOLISHED)
smooth, lustrous, sales appeal

What are the special advantages?

Extraordinary smoothing action produces a micro-polished effect . . . "true metal color" is achieved with a luster not attainable by belts or wheels . . . a wide range of finishes is available . . . plating and enamel adhere better . . . your metal is not surface damaged . . . this all adds up to *product upgrading, new sales values*.

Chemical stability is assured because there are no organic agents to break down . . . process control is easy with all components checkable by direct analysis . . . operations are readily handled by semi-skilled help . . . many types of steel can be treated in the same solution . . . changeover is simple and inexpensive.

What products, what metals can be electropolished?

Automotive trim, aircraft components, appliances, refrigerator and stove trim and parts, kitchen ware, jewelry, tools, wire goods, tubing, plumbing fixtures, hardware, machine parts, and hundreds of other items can be electropolished. Turbine buckets and compressor blades are especially adaptable to electropolishing.

These metals and alloys can be electropolished: . . . Many steels, low-carbon and high-carbon . . . many low-alloy steels . . . stainless steels in 300 and 400 series and other special compositions, particularly 18-8 and 17 chromium stainless steel items. *On stainless steels, electropolishing will produce an especially desirable finish . . . Wrought aluminum alloys . . . certain non-silicon-containing aluminum casting alloys . . . copper and beryllium-copper alloy . . . Monel . . . Nickel . . . Nickel-silver . . . Bronze (single phase alloys) . . . Brass (non-leaded compositions, single phase alloys) . . . Turbine bucket alloys (Nimonic 80, S-816, and others) and compressor blade alloys (such as AMS 5615 and Type 430 stainless steel).*

About ELECTRODEBURRING

This variation of electropolishing is indispensable for smoothing sharp, burred metal for safe handling and precision functioning. The metal can be steel, stainless steel, copper, brass, aluminum. Electrodeburring is ideal for parts having burrs in hard-to-reach areas. For some items electrodeburring plus electroplating produces the best possible and most economical finish. Equipment, solutions and procedures for electrodeburring are similar to those for electropolishing.

For more information about ELECTRO-POLISHING and ELECTRODEBURRING write any of these distributors.

They are fully equipped to help you technically—will send you the new folder, FINISHING—with A PROFIT, which also describes other Battelle-developed processes.

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A timely reminder about why your industry
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Dow Sodium Orthosilicate, solidly established as the *preferred* heavy-duty cleaning compound, is now available in *greater quantity*. Volume production has been inaugurated at The Dow Chemical Company's Midland Division. These new facilities, added to the Sodium Orthosilicate plant in Freeport, Texas, permit Dow to completely meet the increased demand for this remarkably efficient compound.

The centrally located Midland producing point means, too, that Sodium Orthosilicate orders can be processed more rapidly . . . and your shipment reaches you faster. More floor space is freed from storage demands, yet the cleaning operation can proceed smoothly without any fear of Sodium Orthosilicate shortage.

Dow's new, improved full open-head drum is available for Sodium Orthosilicate shipments from Midland as well as from Freeport, Texas. This superior shipping and storage container, designed and manufactured exclusively by Dow, results in definite transit and handling advantages for the user.

These continuing efforts to bring you an economical and uniformly efficient cleaning compound that really does a heavy-duty job . . . these expansions of production and distribution facilities to serve your needs better and faster . . . these improvements in basic package design to cut your handling and storage costs . . . present a convincing answer to anyone in *your* industry who wonders why Dow Sodium Orthosilicate has won wide acceptance. THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS



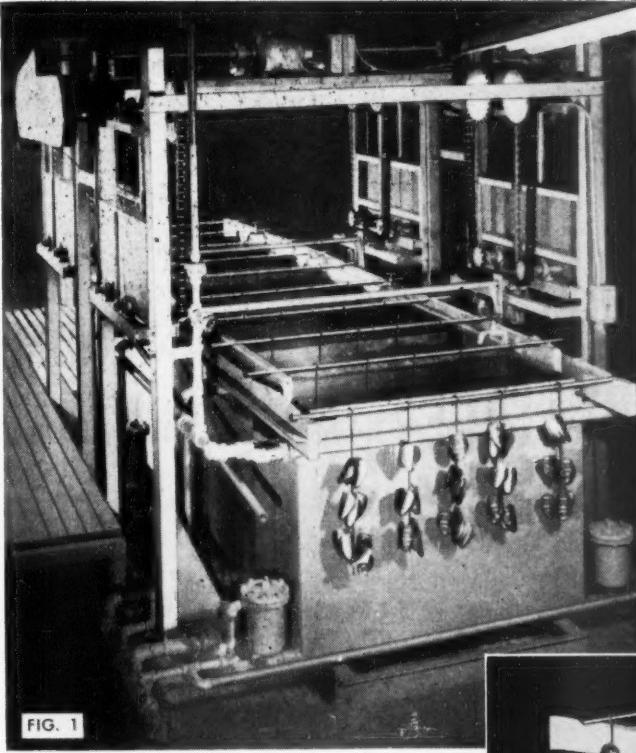


FIG. 1

Fig. 1. Loading End. Loaded racks are hung on rod placed in saddles on transfer frame. At end of each processing period the machine automatically lifts all rods and advances each one tank in the processing cycle.

Fig. 2. Delivery End. Picture shows transfer frame elevated in the transfer operation. When the frame comes down the last rod, which carries parts from the last tank in the processing cycle, will be placed in the unloading saddles on the frame which extends beyond the last tank.

NEW Automatic TRANSFER MACHINE for Pre-Plate Processing

One unit saves labor of 3 to 6 men.

Extremely flexible—different metals such as steel, brass and even die casting can be processed with the same set-up.

Shops that have BELKE Automatic Transfer Machines use them for most of their work.

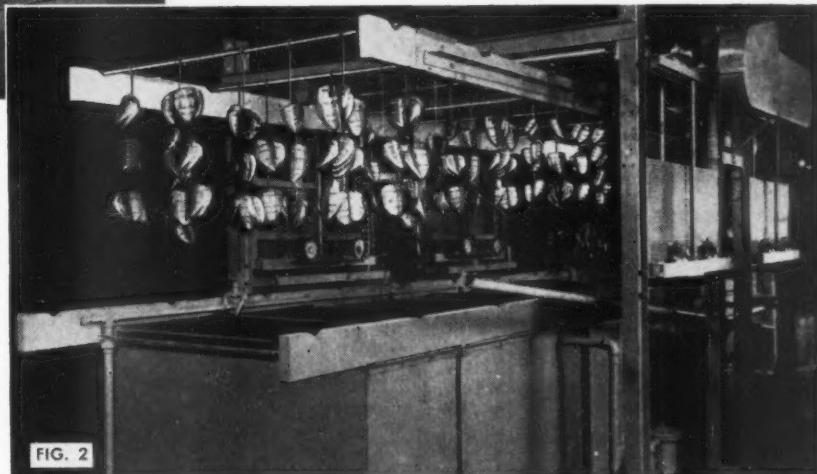


FIG. 2

Features

- Affords practically any required cycle for plating, painting, etching, etc.
- Flexible. Easily adjusted to "skip" tanks for processing articles of different basic metals without changing solution.
- Automatic Timing. Easily set for any processing period from 10 seconds to 20 minutes.
- Uniform Processing. The automatic timer doesn't forget—is not called away. Spoilage is avoided.
- Helps Foreman maintain full production. At a glance he can see partially loaded rods or empty saddles—then locate the cause.
- Available with conveyor-equipped plating tank to which processed work is automatically transferred.

The BELKE Automatic Transfer Machine stops the backaches and high labor costs of processing parts for plating.

The machine automatically lifts and transfers work from tank to tank through the entire pre-plating cycle such as electrocleaning, tepid running rinse, anodic electroclean, cold running rinse, acid bath, cold running rinse, cyanide bath, cold running rinse. Practically any cycle can be had.

The Transfer Unit can be adjusted to "skip" tanks as desired for processing articles of different metals such as steel, brass and die castings. This flexibility makes practical automatic processing of a great range of varied work.

For further labor-saving, a conveyor-equipped plating tank can be furnished with the BELKE Transfer Unit. The Transfer Unit automatically transfers processed work to the conveyor and the work is completely plated while moving through the plating tank.

Send for literature or see your BELKE Service Engineer.



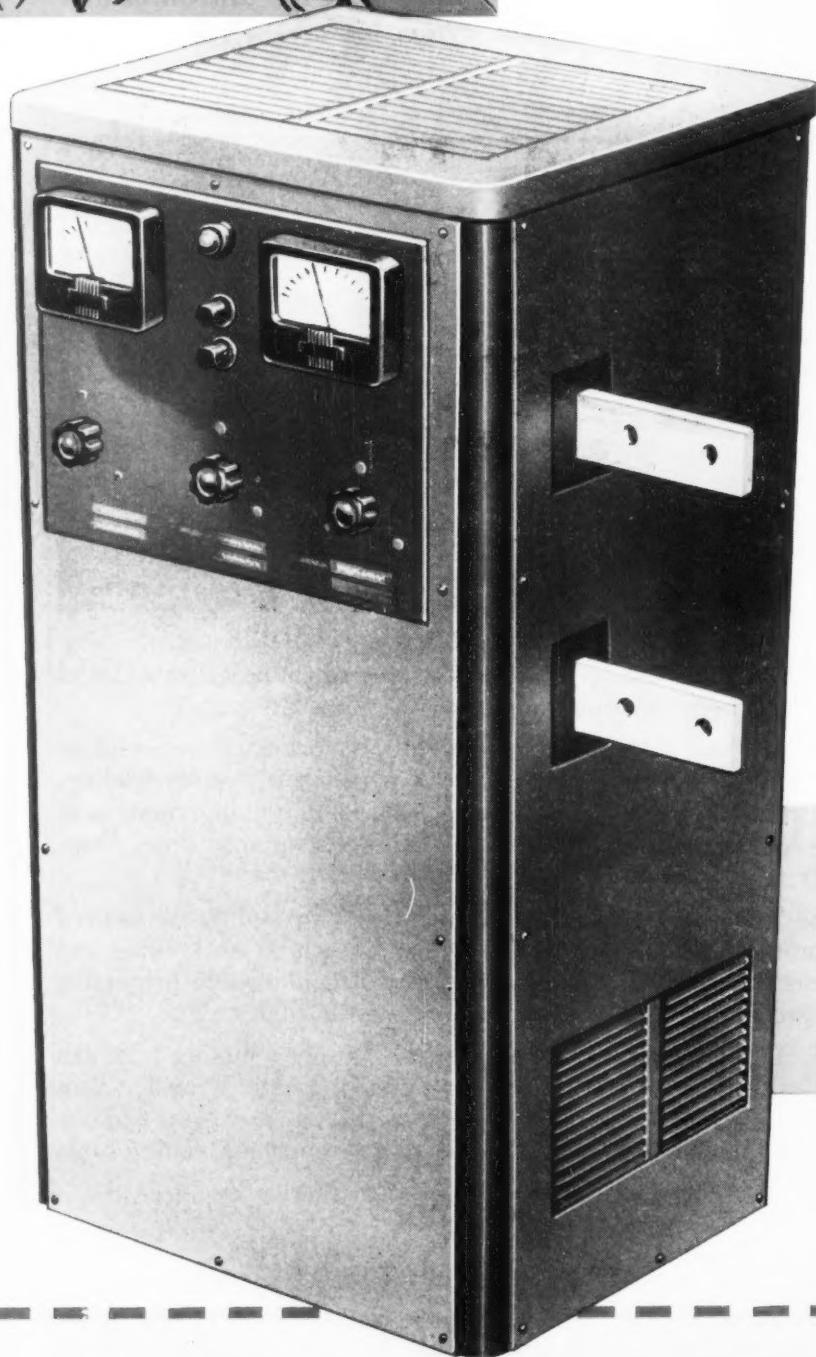
Manufacturing Company, 947 N. Cicero Ave., Chicago 51, Ill.

EVERYTHING FOR PLATING PLANTS



Many hands lighten the load... AND

WAGNER RECTIFIERS' 40% INCREASED STACK AREA PREVENTS OVERLOAD

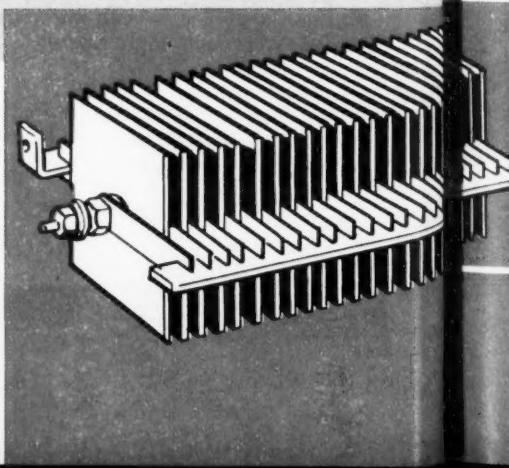


SIMPLE MAINTENANCE AND INSTALLATION

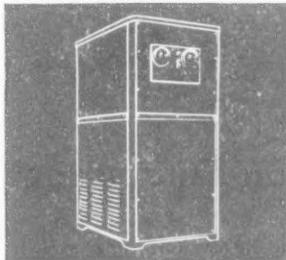
Electrical overloads and over-heating are avoided by ample rectifying stack area. The new Wagner Brothers selenium rectifiers offer you an unprecedented 5.4 square inches of rectifying surface per ampere. We've always rated conservatively, as the year-after-year performance of our previous models will testify. But this 40% increase sets new standards of operating efficiency and reduces your maintenance costs to a record low in electroplating history.

PEAK EFFICIENCY—Excess heating greatly decreases rectifier service life. This conservative Wagner stack design, more plates, greater surface, avoids high temperatures. And in addition, thermal overloads on magnetic contactors protect the equipment should a continued heavy overload occur. Our rugged transformers are especially built for our requirements, and insulated with the highest quality non-flammable insulating materials such as glass, mica and asbestos.

Advanced design and protection features increase service life, make your maintenance simply a periodic operation of oiling the fan and blowing dust from the unit. Installation is completely engineered, no fumbling.

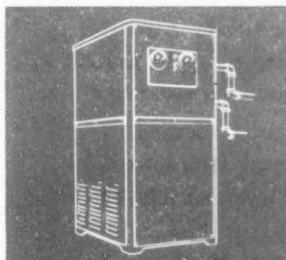


A WAGNER MODEL FOR YOUR SPECIFIC NEEDS



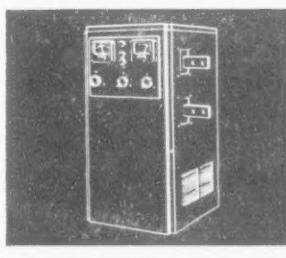
LARGE PACKAGE UNIT

Capacities from 2,000 to 50,000 amperes. Forced-air, fan-cooled type operates at all commonly used voltages. Requires only input and output connections for operation.



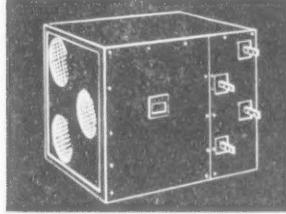
WATER COOLED

Capacities from 1,500 to 50,000 amperes. This unit consists of an air circulating system with a heat exchanger, uses your regular water supply (which can then be used for rinse tanks) as a heat removing medium. Functions well under very corrosive atmospheric conditions, or where extremely high ambient temperature is encountered.



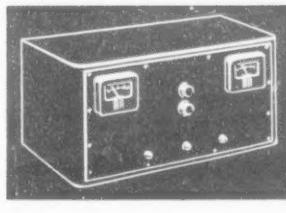
SMALL PACKAGE UNIT

Capacities from 250 to 2,000 amperes. Fan-cooled with exhaust from the top of the cabinet. Very compact to facilitate moving. Requires only three wires for input and output connections. Equipped with ammeter, voltmeter, shunt, starting equipment and regulation if required.



CUBICLE

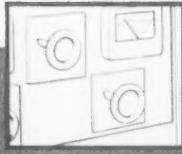
Capacity to 1,500 amperes. Designed for the building block type of operation, since the horizontal flow of cool air permits stacking. The addition or subtraction of total current output is easily accomplished.



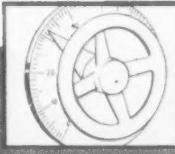
BENCH TYPE

Capacities from 5 to 200 amperes. Special design affords extreme flexibility of operation and meets exacting requirements of control, ripple and accuracy ideally suited to laboratory research and development work.

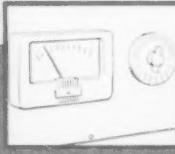
REGULATORS AND CONTROLS



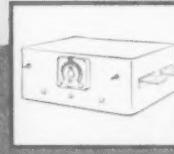
TAP SWITCH—Tapped auto-type transformer for phase selection makes changes under load without interruption.



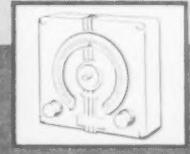
POWERSTAT—Continuous control as voltage is changed. Toroid wound auto-type transformer.



SATURABLE REACTOR MAGNETIC AMPLIFIER—Automatically stabilizes control of either voltage or current.



CURRENT REVERSAL UNITS—Standard units available in multiples of 250 amperes.



CURRENT INTERRUPTION UNITS—For use where periodic interruption of dc current is desirable.

YOUR PRIMARY SOURCE FOR PLATING AND POLISHING EQUIPMENT AND SUPPLIES

Wagner **BROTHERS, INC.**

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Chicago • Rochester • Cleveland • Cincinnati • St. Louis
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avoid stream pollution due to chromium waste...

...with W&T
Sulphur Dioxide Reduction Equipment

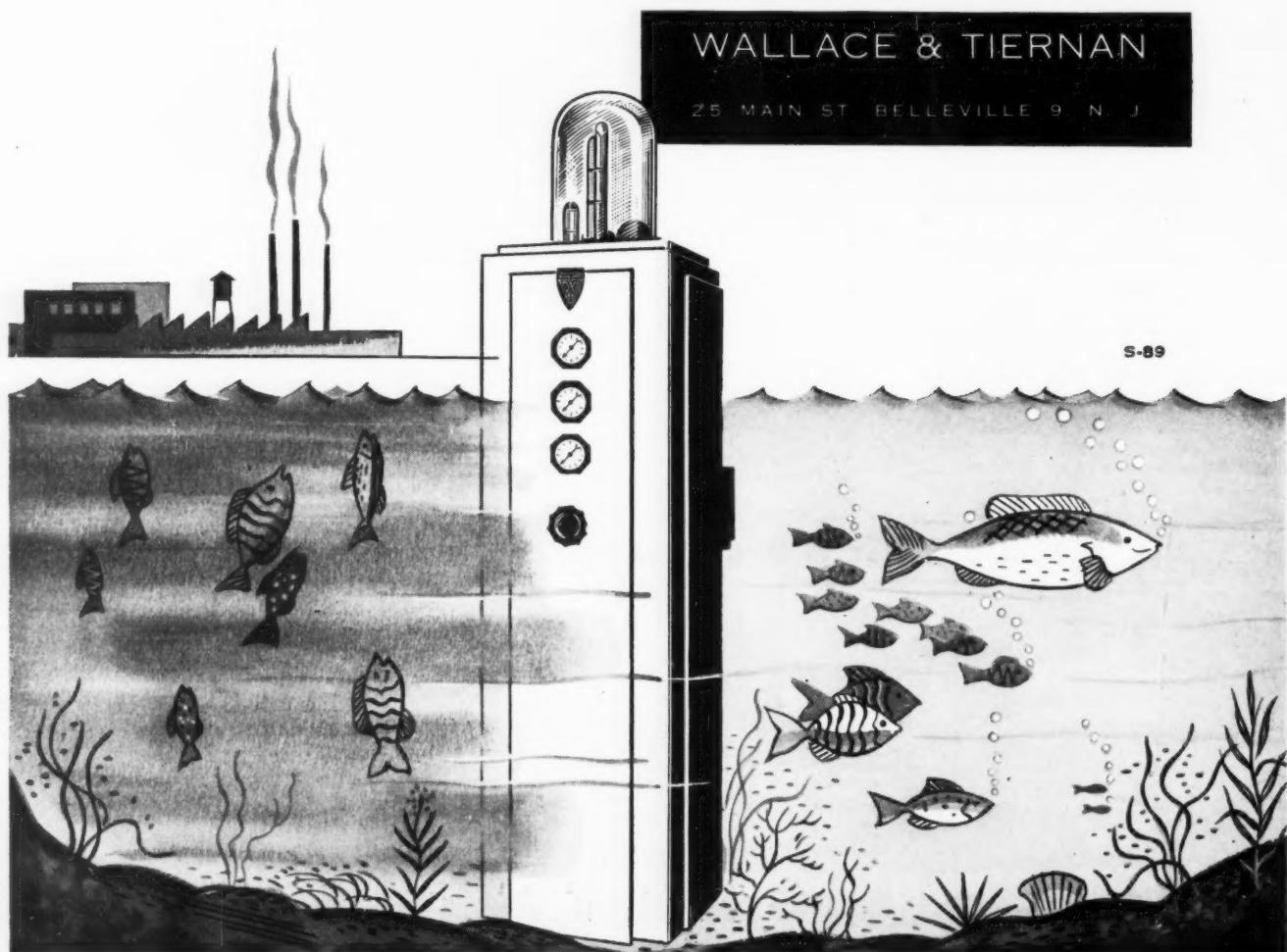
With the proper treatment equipment, toxic hexavalent chromium can be reduced by sulphur dioxide to the trivalent form and then completely precipitated by alkali for standard removal to a disposal area — such as a lagoon. After this treatment the waste water can be drawn off and safely disposed of in the usual manner. This treatment is in full compliance with most local and state pollution abatement laws.

Wallace & Tiernan offers the heat treating and metal finishing industries several types of Sulphur Dioxide Feeders with optional controls for manual, semi-automatic or fully automatic operation. These feeders are adaptable to either the "batch" or "flow-thru" methods of treatment in both large and small plants.

Similar equipment is also available for the destruction of cyanide waste by alkaline chlorination.

W&T offers PROVEN EQUIPMENT — hundreds of similar units are serving industry today, EXPERIENCE — over forty years of building chemical feeding equipment, and SERVICE — field representatives are located in principal cities throughout the country.

Write today for additional information on W&T Sulphur Dioxide Feeders and Alkaline Chlorination Equipment, at no obligation to you, of course.



LEA-RONAL

Bright Copper

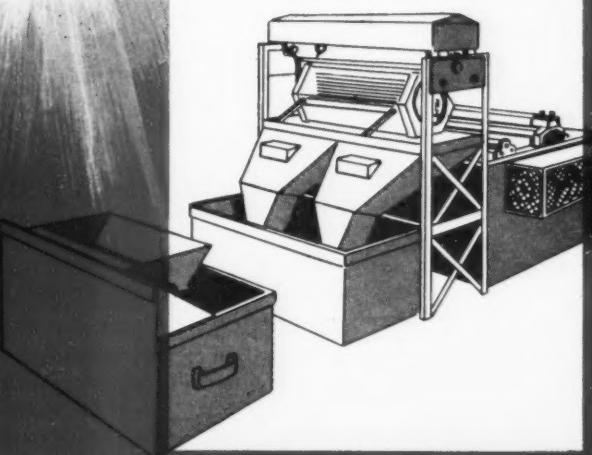
FOR
BARREL
PLATING

Speed

Lea-Ronal Bright Copper can be plated at current densities 2 to 3 times higher than conventional barrel formulations.*

Savings

- In copper cyanide
- In burnishing
- In floor space
- In additional equipment



*One manufacturer, formerly barrel plating small steel stampings with 2.5 amperes per gallon of solution, changed to Lea-Ronal Bright Copper and has been able to obtain brighter deposits with 6 to 7 amperes per gallon of solution.

Other advantages of Lea-Ronal Bright Copper for Barrel Plating are (1) excellent anode corrosion resulting in minimum metal cyanide addition; (2) bright, soft ductile deposits; (3) maximum bath efficiency with longer bath life (carbonate build-up not detrimental); (4) many items being racked and plated in still tanks can now be plated satisfactorily in barrels with Lea-Ronal Bright Copper.

Just as operators of still tanks have found Lea-Ronal Bright Copper (utilizing Lea Copper Glo) extremely worthwhile, so will you find Lea-Ronal Bright Copper for your barrel plating also much more effective than conventional barrel solutions and methods. Why not place a trial order and make your own comparisons?

Lea-Ronal Bright Copper for barrel plating (for which Lea Copper Glo is an essential ingredient) is marketed exclusively through The Lea Manufacturing Co., 16 Cherry Avenue, Waterbury 20, Connecticut. Your inquiry should be addressed to that company.

Lea-Ronal Inc.

Main office and laboratory: 42-48 27th Street, Long Island City 1, N. Y.

Sales and manufacturing plant: 237 E. Aurora Street, Waterbury 20, Conn.

A SPECIAL REPORT ON PROTECTIVE FINISHES FOR ALUMINUM

Most aluminum producers and fabricators are well aware of the superiority of chemical finishes over anodizing for the protection of aluminum from corrosion. Naturally, then, there is a running battle for acceptance among the leading producers of the protective chemical finishes.

That's why, here at Allied, we have always studied your needs with regard to both our own and competitive processes. We're constantly trying to produce new and better finishes because we believe there's always room for improvement . . . even to our own products. Some years ago this policy led to the introduction of a process, long in development, that offered you a way to overcome anodizing's obvious technical complications . . . Iridite #14. This finish was far easier to use than anodizing, yet provided comparable, if not superior, quality. And, its cost was much less than anodizing.

But other finishes offering similar advantages over anodizing have entered the market. So . . . the current battle for acceptance. By any cost comparison Iridite #14 is the most economical. However, corrosion tests by users show contradictory results as to performance from Iridite #14 and other leading protective finishes for aluminum. Most tests show Iridite #14 superior, but some do not. The margin of difference, however, is always small. The truth is that all have proved good. However, our laboratory research indicated that still further improvements could be made.

That knowledge . . . plus our aim to give you even better protection and maintain the leadership of the industry, is exactly why Allied Development Engineers have been working for long years to develop a better finish than any of those now available, including our own Iridite #14.

Now the new finish is ready for you. It's called Iridite #14-2 (Al-Coat).

From a performance standpoint, Iridite #14-2 gives you two important advantages in the protective finishing of aluminum.

FIRST: in its fully colored brown film stage it provides corrosion resistance decidedly superior to previous processes.

SECOND: the basic brown film can be hot water bleached to produce a clear-type film with protection heretofore unobtainable from clear-type chemical finishes.

From an operating standpoint, new Iridite #14-2 gives you three important advantages.

FIRST: it provides consistently

higher corrosion resistance for different aluminum alloys treated in the same bath.

SECOND: it provides a more uniform appearance for parts of different alloys and with varied surface finishes before treatment.

THIRD: its operating and technical characteristics are superior to those of other processes.

If you are using or planning to use a chemical finish for aluminum, you should have full details on new Iridite #14-2. Write us or send samples for free test processing. Or, for more immediate advice, call your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book. - - - ALLIED RESEARCH PRODUCTS, INC., 4004-06 EAST MONUMENT STREET, BALTIMORE 5, MARYLAND.

P. S. Even new Iridite #14-2 will be constantly measured against both your needs and competitive processes to make sure you get the best possible, most economical finish for your product that man and the laboratory can develop.

Completely automatic, unattended unloading end of the Stevens Automatic Barrel showing control panel and rectifier site located above machine.



**Unistrut says—
"COSTS 50% LOWER—
FINISH BETTER with . . .**

**STEVENS AUTOMATIC
BARREL MACHINE"**

Every day in the Unistrut Corporation plant, Wayne, Michigan, thousands of small parts are zinc plated and shipped to Unistrut warehouses throughout the United States. All of these parts are zinc plated automatically by a Stevens Automatic Barrel Machine.

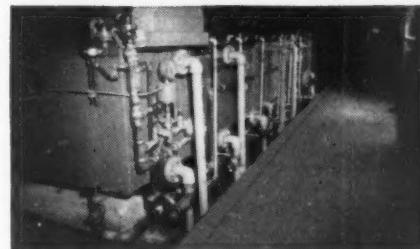
Unistrut high standards require a uniformity of plate on the parts used in their metal framing systems. But since installing the Stevens Automatic Barrel they have reported other advantages as well—"less handling, smaller inventories and quicker shipments." When you consider the 50% cost savings of actual plated parts too, it all adds up to a terrifically profitable investment.

Why don't you tell us your metal finishing problems and let us make recommendations. There's no obligation. Write to—

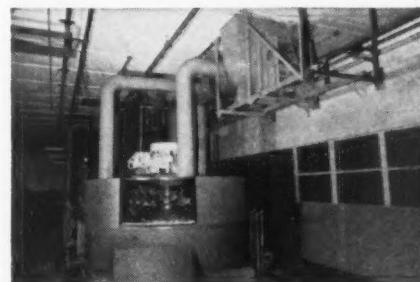
**BRANCHES: BUFFALO • CLEVELAND • INDIANAPOLIS
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Metal Finishing equipment and supplies from castings or stampings to finished product.

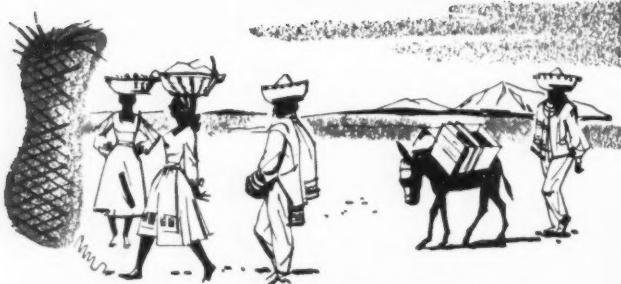


Side view of machine showing excellent drainage system.



Plating section of machine with ventilating duct work.

**FREDERIC B.
STEVENS**
INCORPORATED
YOUR METAL FINISHING SUPERMARKET
DETROIT 16, MICHIGAN



From MEXICO
... and **JOE-D**

Come the Original
**BIAS SISAL
BUFFS**

GUARANTEED FRAYPROOF PERFORMANCE!

The high-quality sisal used in every JOE-D Buff is grown and specially woven for JOE-D in Yucatan, Mexico. Top quality raw material is one reason why JOE-D Sisal Buffs are the finest on the market — fast-cutting, long-lasting. And JOE-D's original bias construction guarantees **fray-proof** performance — never a loose thread end to scratch or mar. Insist on original quality . . . specify JOE-D — you can't buy a better buff!

The JOE-D line covers a complete selection of Bias, Bias Sisal, Bias Spoke (Finger) and Conventional Buffs—as well as quality Polishing Wheels.

Holders of the original patent on Bias Sisal Buffs—
U.S. Pat. No. 2642706

**ATTENTION
JOBBERS!**

Some choice territories still available.
WRITE TODAY!

the JOE-D Buff Company

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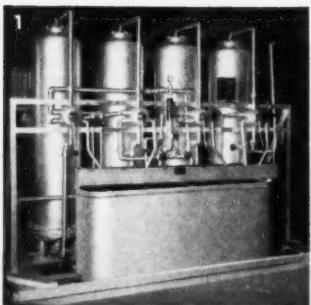
FINISH IT . . .

FASTER — BETTER — CHEAPER

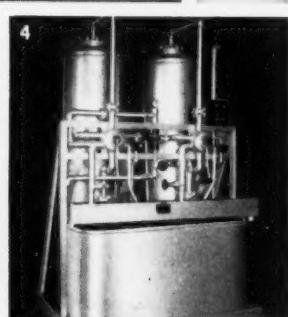
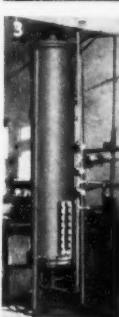
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Barnstead
WATER DEMINERALIZERS

— Better Plating, better Finishing
with **MINERAL-FREE WATER**

#1 FOUR-BED
Capacities up to 2500 gallons per hour. Shipped complete, ready for water line.



#2 MODEL BD 2
5 to 25 gallons per hour under pressure. Connects to any tap.



#3 MIXED-BED
Capacity of 500 gallons per hour. Low cost, 5¢ for 1000 gallons.

#4 TWO-BED
1000 gal/hr of pure water for plating, anodizing, etc.

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BARNSTEAD ALSO MANUFACTURES A COMPLETE LINE OF DISTILLED WATER STILLS

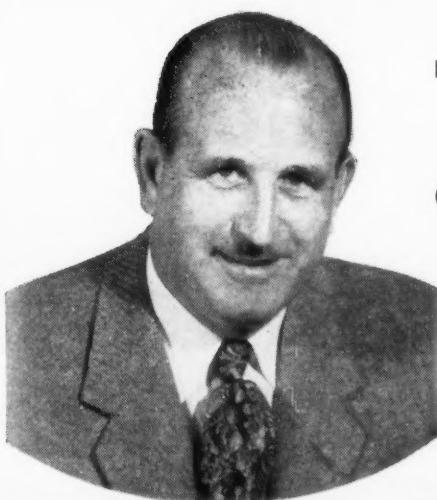
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TRADE MARK REG. U. S. PAT. OFF.
Barnstead
STILL & STERILIZER CO.

FIRST IN PURE WATER SINCE 1878

10 Lanesville Terrace, Forest Hills, Boston 31, Mass.

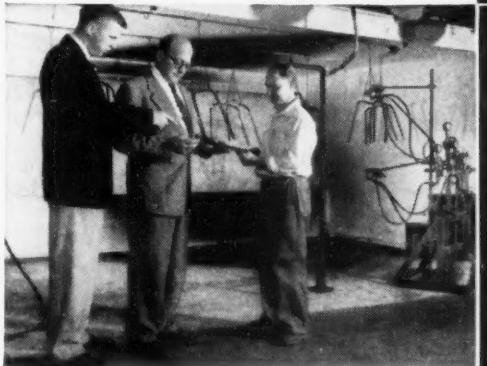
METAL FINISHING, February, 1955



Phil Virtue, president, Virtue Bros. Mfg. Co., Los Angeles, Calif., says:

"Wyandotte PRE-FOS and F.S. definitely clean metal better...at lower cost!"

① At Virtue Bros. Mfg. Co., this tremendous automatic plating machine (the largest on the West Coast) runs steel furniture parts through a complete cleaning and plating cycle. Wyandotte F.S., outstanding steel electrocleaner, is used in the two cleaning tanks. F.S. provides: exceptional detergency, fast and complete wetting action, controlled foaming, very free rinsing, high soil suspension, and long solution life.



② Besides F.S., Virtue Bros. use Wyandotte PRE-FOS in a spray washer, to clean and phosphatize steel parts perfectly for painting. H. W. Rueckert (center), Virtue Bros.' plant engineer, and C. Stinnett (right), paint department foreman, examine a painted part with Ken Clayton, Wyandotte representative. PRE-FOS works wonders in hard or soft water, in a spray washer or soak tank.

Virtue Bros. Mfg. Co. is the West's largest manufacturer of chrome and black metal dining furniture. Like many makers of metal products, this company prefers Wyandotte F.S.* for metal cleaning prior to plating, and PRE-FOS* for metal cleaning and phosphatizing prior to painting, because *Wyandotte products provide excellent cleaning at lowest use-cost*. Virtue Bros. is well pleased, also, with the services of Wyandotte's skilled technical staff.

Wyandotte offers a performance-proved line of metal cleaners, phosphatizers, paint strippers, and related products. If you have a metal-cleaning problem — or would like to see how Wyandotte products can improve your operation and, at the same time, cut costs — call your Wyandotte representative or jobber today! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California.*

*REG. U. S. PAT. OFF.



Wyandotte CHEMICALS

Helpful service representatives in
138 cities in the U.S. and Canada

ONLY HENDERSON OFFERS THIS 3-PIECE CONSTRUCTION

1 2 3



Save as much as 40%

In all Henderson Horizontal Cast Tumbling Barrels, one of which is shown above, the ends are separate from the body. As the body carries the load, it wears out long before the ends do. For a long time, therefore, with Henderson barrels, you will need to replace only the bodies, merely bolting on the original ends. Compared with the cost of complete new barrels, you can thus save as much as 40%!

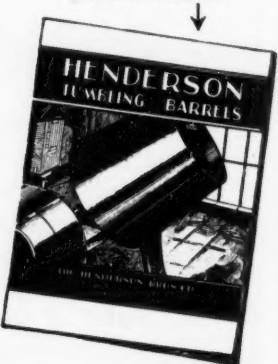
After long experience in the finishing field, we like to recommend cast-iron barrels for most deburring and grinding jobs, but we make rubber, Neoprene, and wood-lined barrels — over 25 types, a barrel for every conceivable finish. Besides the highest quality of material and workmanship, when you buy a Henderson, you get a lot of "know how"!

THE HENDERSON BROS. COMPANY

"The Tumbling Barrel People"

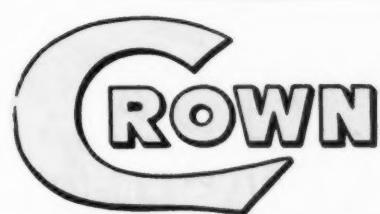
133 SOUTH LEONARD ST., WATERBURY, CONN.

If You're A
"Tumbler"
Send for This
NEW
CATALOG

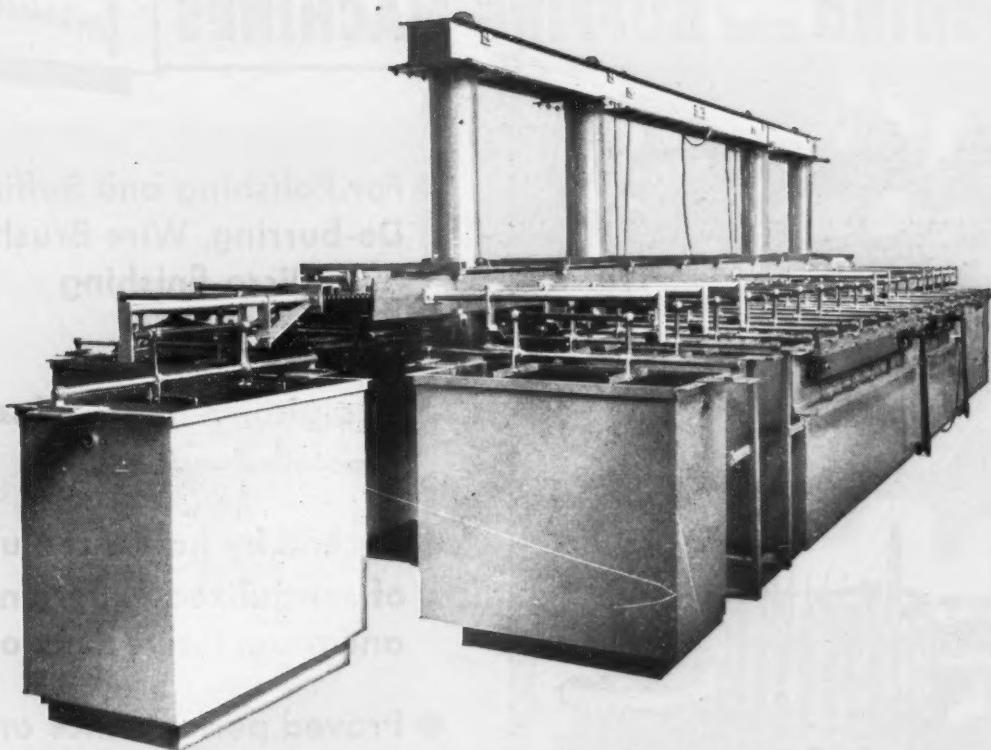


SINCE 1880 DESIGNERS AND BUILDERS OF TUMBLING BARREL EQUIPMENT





TYPE "B" AUTOMATIC



you'll be agreeably surprised . . .

- At the high production
- At the low cost
- At the high quality
- At the low rejections

Whether your plating requirements are for high production of small parts or moderate production of large parts, there is a Crown Type "B" machine that will automatically travel your work through the entire treatment cycle — on schedule.

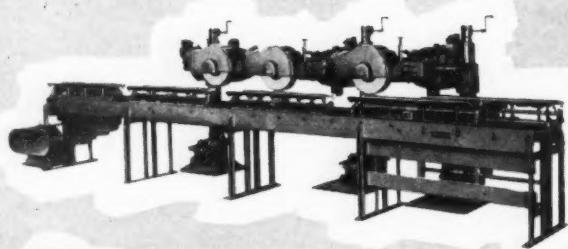
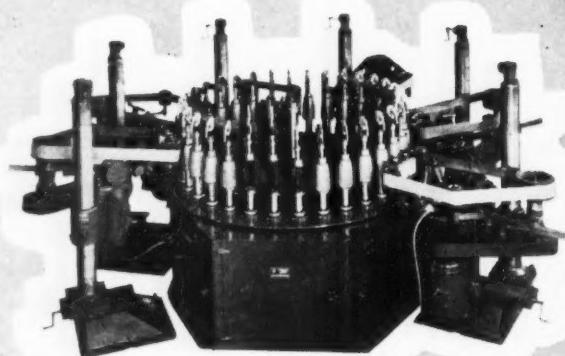
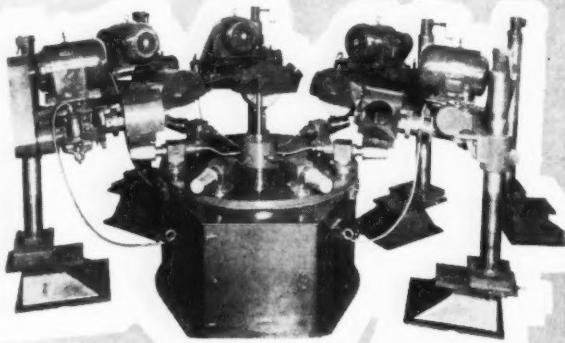
Write us details of your treatment cycle and production requirements for further information

CROWN RHEOSTAT AND SUPPLY COMPANY

3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

ACME Automatic POLISHING and BUFFING MACHINES

are engineered for low cost, high production finishing...



- For Polishing and Buffing, De-burring, Wire Brushing and Micro-finishing
- Rotary Automatics
Straightline Automatics
Semi-Automatics
- Backed by half a century of specialized experience and progressive development
- Proved performance and dependability in industry

RECOMMENDATIONS and QUOTATIONS

• We will be pleased to receive blue prints or preferably finished and unfinished samples of the part you contemplate finishing together with detailed information on present finishing operation and production requirements. On receipt of samples and data we will offer recommendations and quotations.



ACME Manufacturing Co.

Builders 1400 E. 9 MILE RD., DETROIT 20 (Ferndale) MICH.
OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY

CATALOGS ON REQUEST



HARSHAW

PERGLOW

HARSHAW

Nubrite

Two NEW Harshaw Bright Nickel Plating Processes

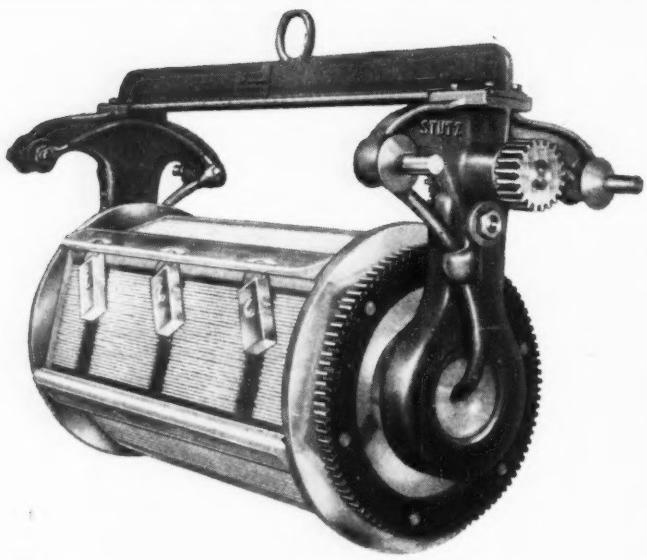
Each of these new outstanding Harshaw bright nickel plating processes has certain unusual characteristics which fit it to the product finish required in your plant.

Top brightness with thin deposits . . . Especially outstanding color performance in applications where little or no basis metal finishing is done prior to plating . . . Perglow or Nubrite deposits are extremely receptive to chrome plating . . . Unique leveling results of Perglow or Nubrite have a hiding and filling effect on surface defects which other nickel deposits tend to emphasize. Polishing costs are decreased.

For application in your plant, phone or write our nearest office.

THE HARSHAW CHEMICAL COMPANY
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Chicago 32, Ill. • Cincinnati 13, Ohio • Cleveland 6, Ohio • Houston 11, Texas • Los Angeles 22, Calif.
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STUTZ PLATING BARRELS

Of High Temperature

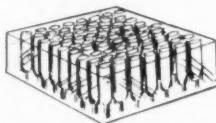
For:

- Heavy Duty Production
- Highest Possible Current
- Complete Cycle—all solutions
(temperature to 185°F)

Stutz Plating Barrel Unit for continuous operation through Alkali Cleaning, Acid Pickling, Acid and Alkaline Plating solutions and rinsing. Largest number of cylinder perforations possible.

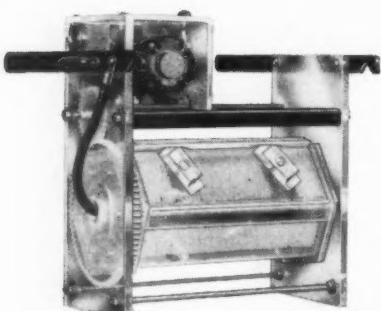
Stutz Plating Barrel Unit, Motor Drive Mounted Overhead. Continuous rotation of cylinder from one operation to another and where a minimum of solution dragout is important. Roller bearing chain drive to absorb load shock. On a complete Barrel Plating installation, this type of equipment can be made at lower cost since motor drives are not required on each tank station.

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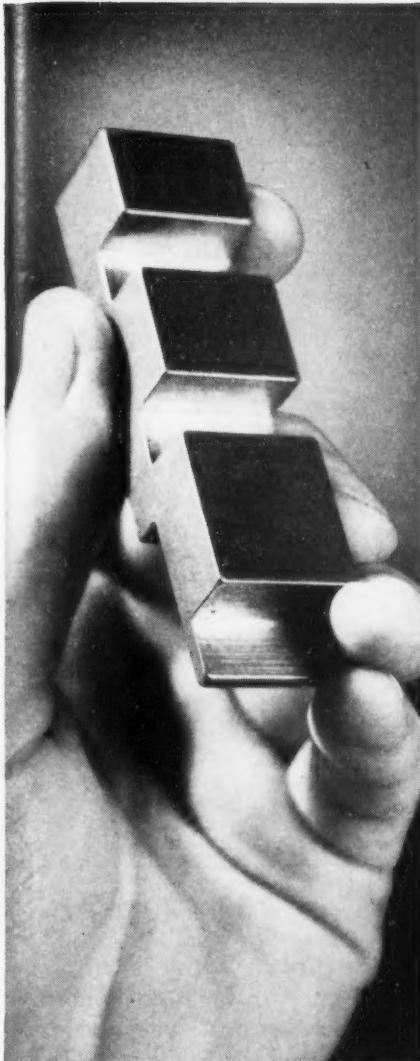
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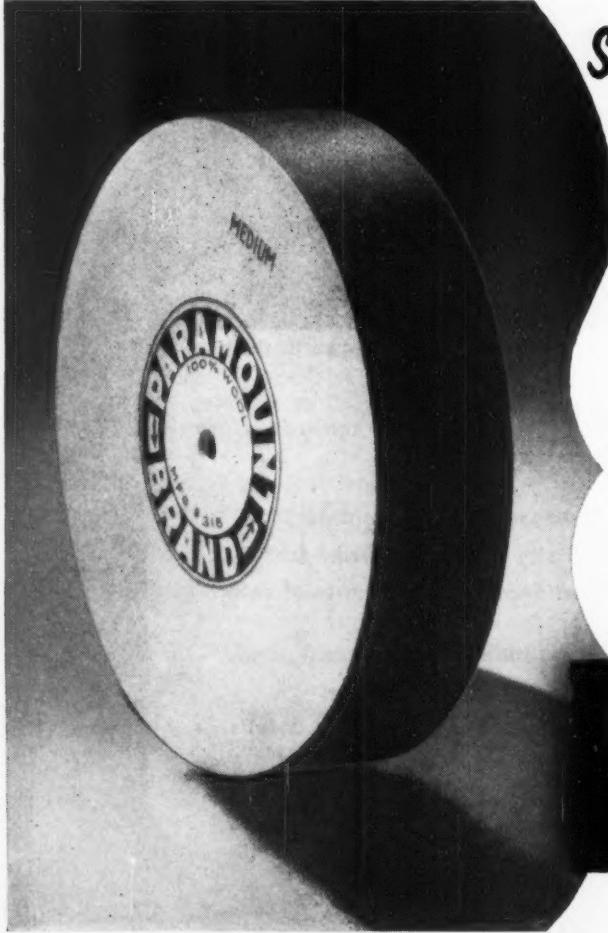
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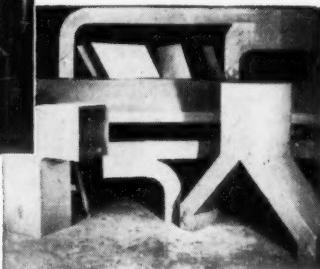
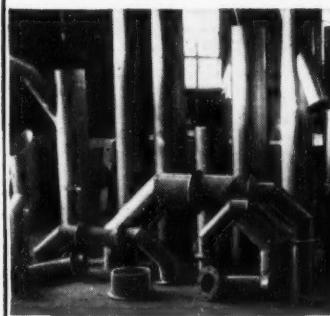
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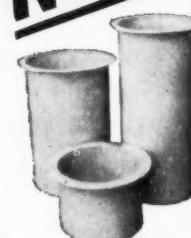
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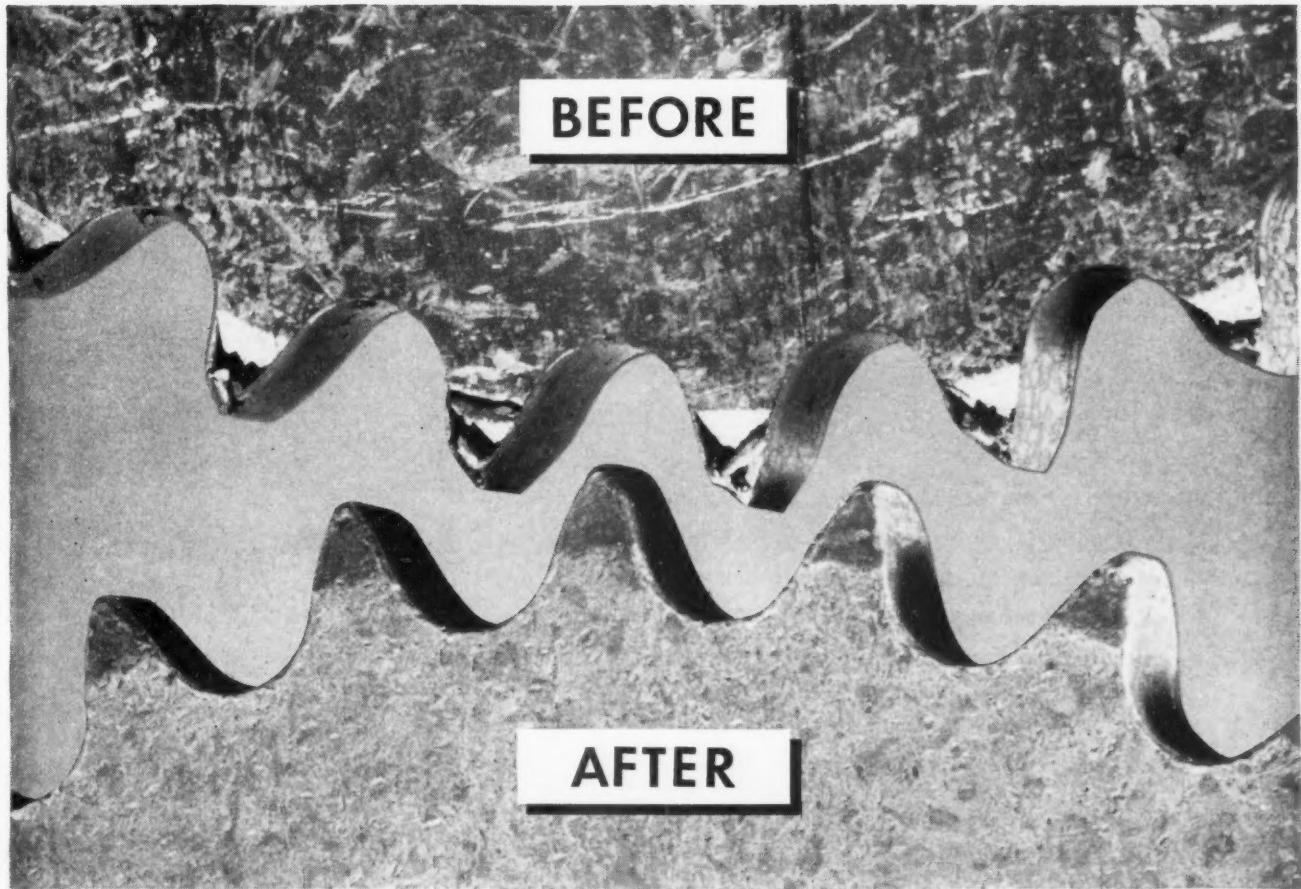
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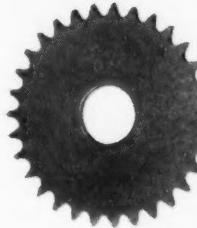
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BEFORE AND AFTER photos show how the HONITE Method finishes steel roller chain sprockets. Note how smoothly and evenly the stubborn hobbing burrs have been removed.

Milwaukee manufacturer finds... HONITE BARREL FINISHING CUTS COSTS 60%



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steps are performed simultaneously. And with a more uniform finish, parts are cleaner; burrs and scales are eliminated completely.

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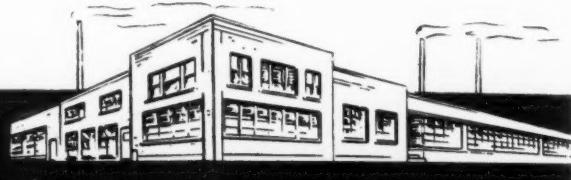


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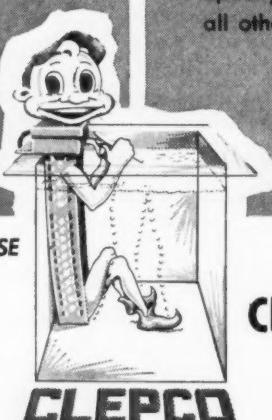
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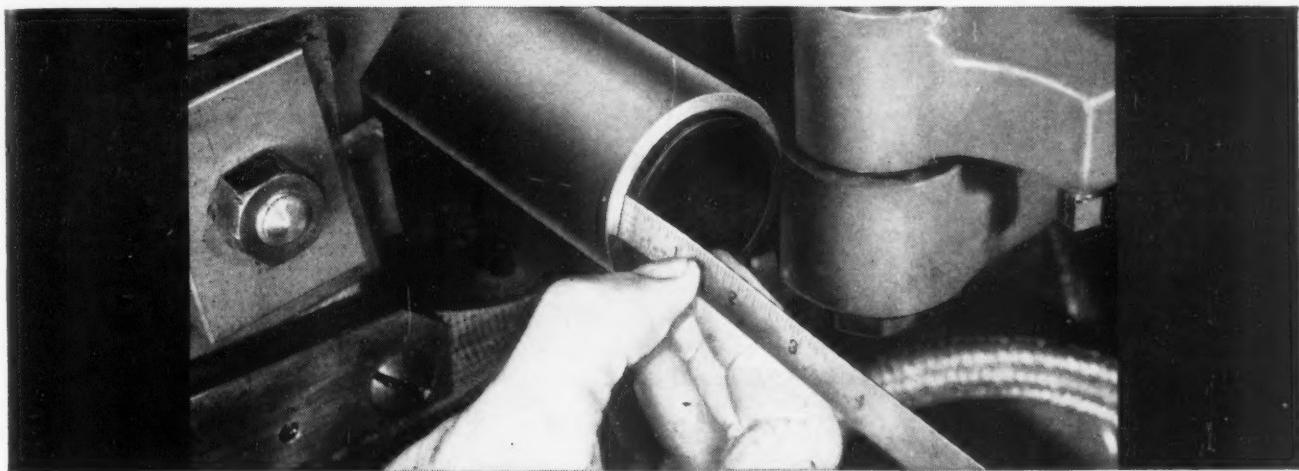
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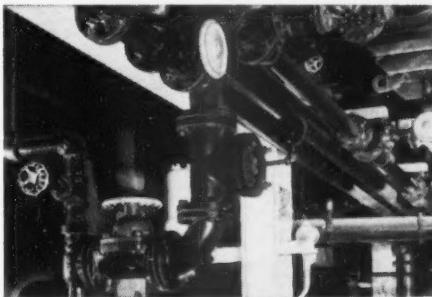
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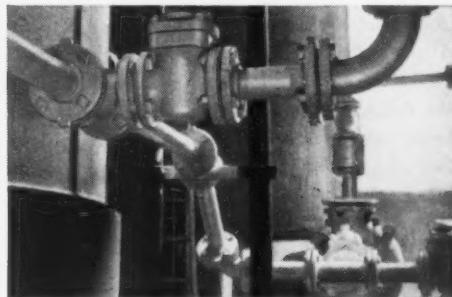
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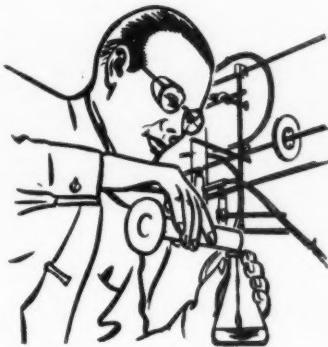
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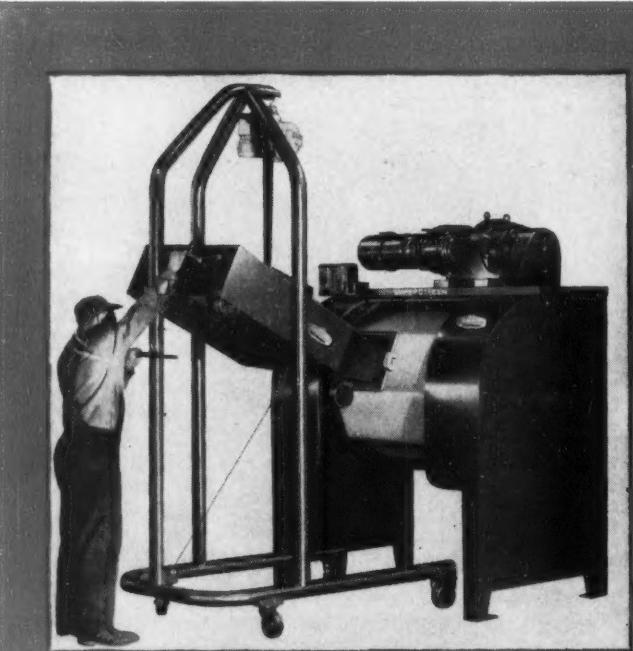
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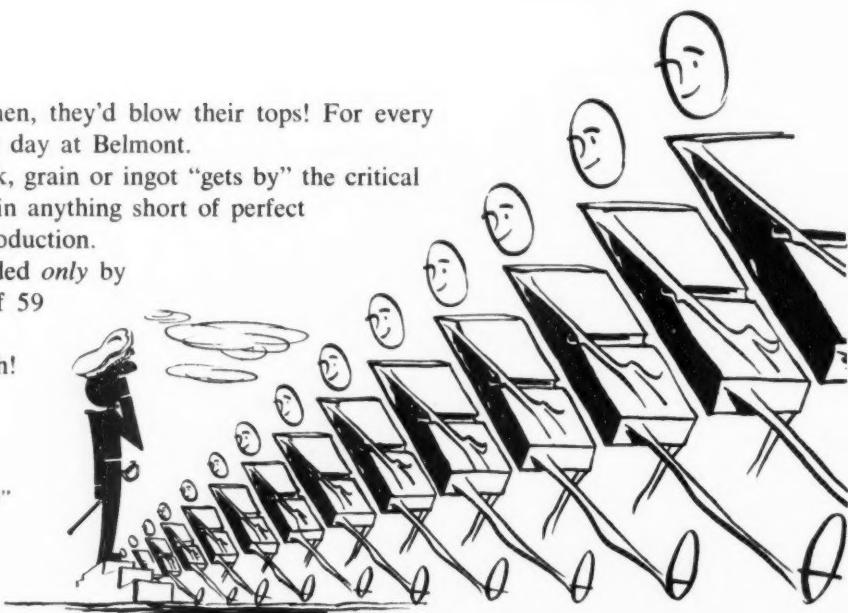
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An article dealing with a course in the fundamentals of chemistry, in order to understand the studies constantly being made to overcome plating difficulties in the plating bath.

The use of potassium oxalate as a complexing agent in the boric acid analysis in nickel solutions.

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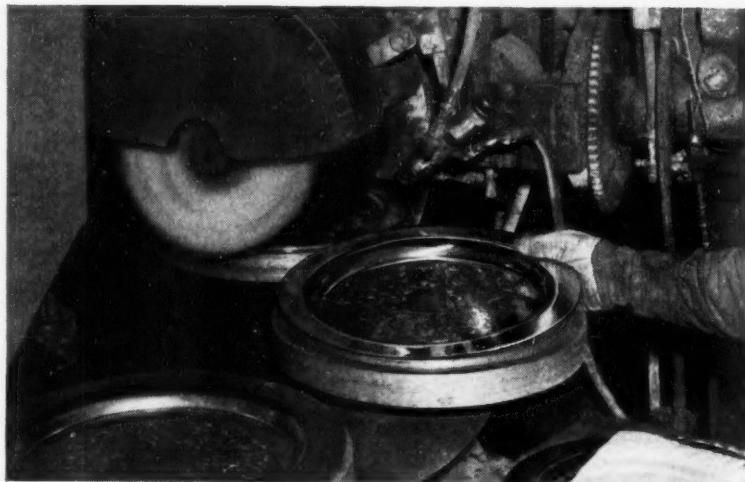
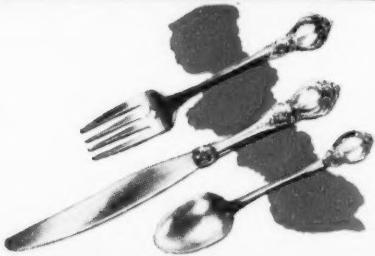


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Electroplated vs. Electroless Nickel

The publicity associated with the recently developed improvements in the process of nickel deposition by chemical reduction, without the use of current and anodes, has given rise to widespread consideration of its employment as a substitute for electroplating. Although the recently published survey by Dr. Brenner (*METAL FINISHING*, Nov. & Dec. 1954) described the present status of this unique process in complete detail, we feel some further comment is necessary, mainly to put to rest some of the fears expressed by nickel platers as to the future of conventional nickel plating.

The deposit usually contains about 7% phosphorus and is applied at the rate of about 0.6-1.0 mil per hour so that, although the corrosion resistance appears to be excellent, it does not show to advantage where purity and speed are factors. The coating cannot be applied on zinc base die castings or soft soldered joints, which precludes its use on a large variety of fabricated products. Although material costs vary according to the types of articles processed, they will run at least four to five times the cost of anodes and chemicals used in electroplating.

On the credit side, an inherent characteristic of the process is uniformity of deposit, so that there is no significant buildup on projections such as threads and edges whereas, in electroplating, one may be forced to overplate excessively in order to obtain sufficient thickness in recesses. Also, because of the practically perfect throwing power, deposits can be applied to the inside of articles such as valves and electronic components, which would be impossible to reach in the electrolytic process, even with auxiliary anodes.

Claims, such as absence of porosity and labor saving due to elimination of special plating racks, may be considered over-enthusiastic to a great extent. Because of the tendency to decompose spontaneously when fine particles are present in the electroless bath, good filtration is a must. Observing the same precautions in an electroplating bath, nickel deposits can also be obtained with practically no porosity, even in thicknesses as low as 0.1-0.2 mils. Allowing for possible exceptional situations, we would judge that, in general, possible savings in the labor of preparing and maintaining racks is more than balanced by the necessity to remove nickel deposits from the walls of the equipment at frequent intervals.

Electroless nickel, effectively employed, can be a very valuable tool for the metal finisher. Our personal experience leads to the conclusion that, where electrodeposition is impracticable, electroless nickel may be the answer. It has far to go, however, before it can be considered competitive.



The Use of Filters in Electroplating

By J. B. Mohler, *Metal Finishing Consultant*

and Charles E. Crowley, *President, Alsop Engineering Corporation*

Introduction

CONTINUOUS production at competitive cost is only obtained through control of the quality of the product. Modern quality control of electroplated items is obtained by the engineered usage of filtration as a control factor.

Filtration is the only practical method of keeping a plating bath clean. Filterable particles continuously enter the bath from a number of sources and, after these reach a sufficient concentration, rough, porous, or off-color deposits will be obtained. Also, colloidal materials sometimes accumulate in the bath, causing unacceptable deposits. These can only be removed by filtration through an adsorbing medium, such as activated carbon.

Suspended solids in the bath can cause rough and porous deposits by occlusion during plating. Colloidal impurities can cause rough plating, trees, peeling, loss of adhesion, dark plating and loss of plating range.

Sources of Contamination

Every effort should be made to keep solid and colloidal materials from entering the bath in excessive amounts. It is really a matter of cleanliness and purity. By keeping the production area clean and by the use of plating quality chemicals and anodes, contamination can be kept to a minimum. However, it is not possible to keep the bath clean by good housekeeping alone. Solid particles will enter the bath from dust in the air. Harmful solid particles are suspended in the air due to grinding and cleaning operations within the plant, open windows, or any operation that will create or stir up dust.

A common source of contamination is the anode sludge. Even with high purity anodes, a sludge is very common in many baths. If this is serious it is advisable to bag the anodes to keep this source of contamination to a minimum. Anode sludges form due to polarization of the anodes and production of anode films which float off, due to insoluble impurities in the anodes, and due to release of grains of metal during anode corro-

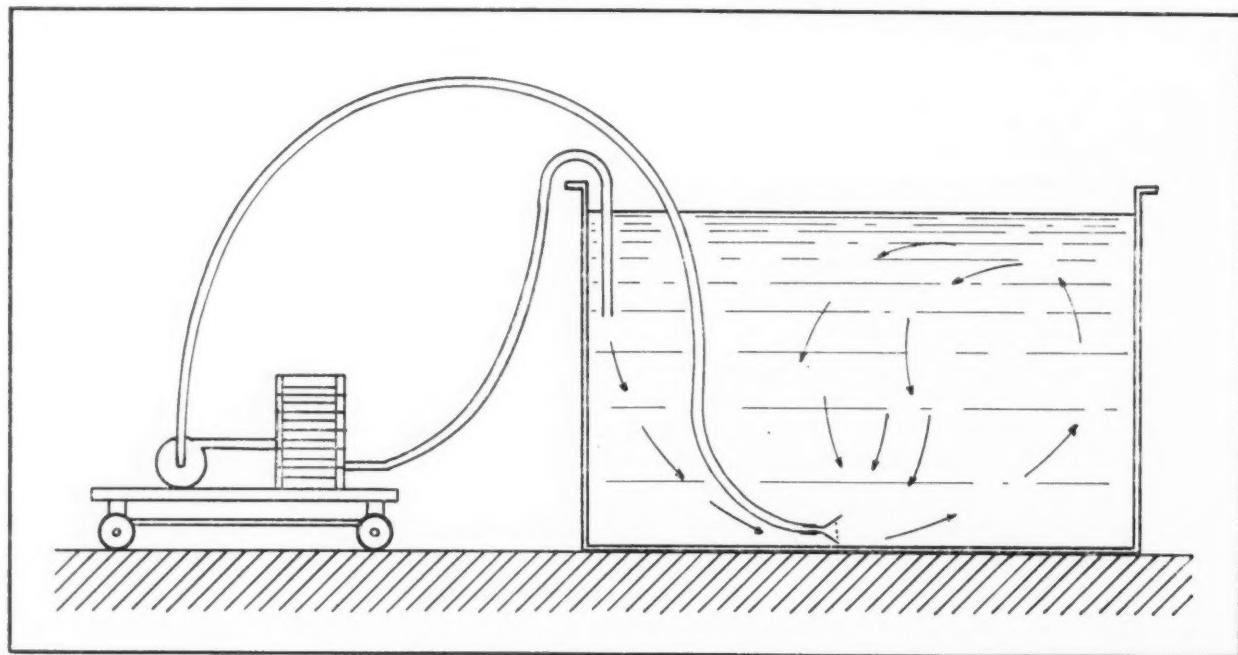


Figure 1. Use of Hoses for Filtration.

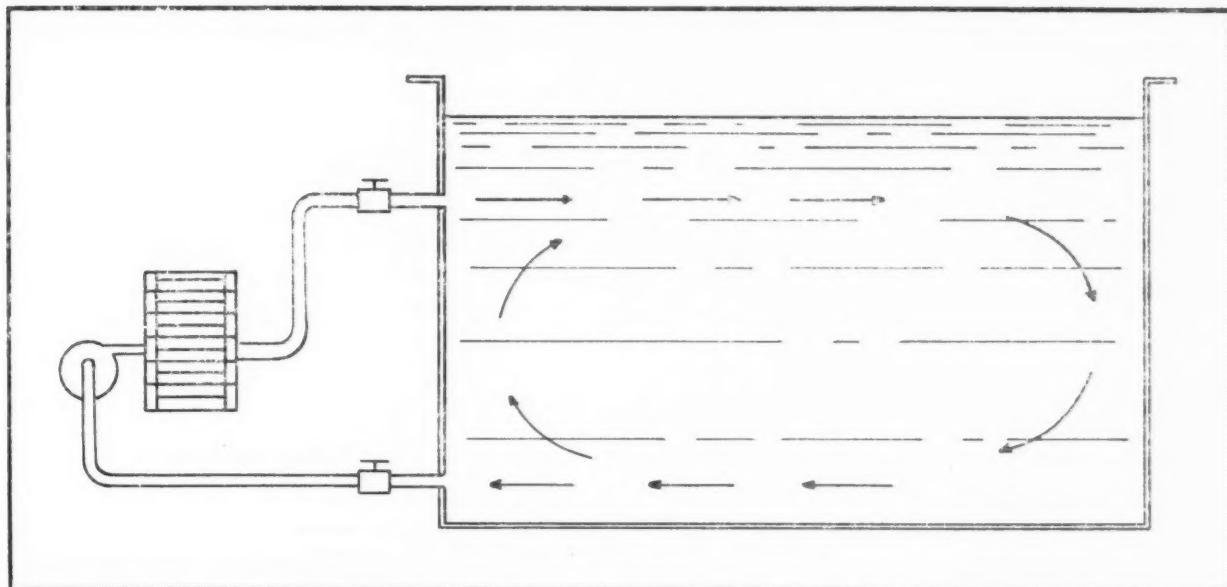


Figure 2. Continuous Filtration.

sion. Also, the anode sludge is often charged, so that it is readily attracted to the cathode.

Rust and scale from metal parts near or above the tank are a frequent source of contamination. This source of contamination can be reduced by cleaning and painting metal parts in the near vicinity.

Chemicals very often contain solids, which remain behind after the chemicals are dissolved. This source is generally not serious in the case of small additions required to maintain a controlled bath with plating quality chemicals. However, it is often a factor when a fresh bath is made up. It is particularly an item for chemicals that are made by precipitation methods, where solid particles are occluded and collected during the manufacture of the chemicals. Crystalline chemicals are generally of higher purity.

When a fresh bath is made with hard water, precipitates will form by the reaction of alkaline chemicals with the calcium and magnesium salts in the water.

Many chemicals decompose with time so that in some baths insoluble salts are formed during use as a result of chemical decomposition.

During plating, impurities can be dragged into the bath as dirt or solid materials on the work. This can consist of grinding compounds, buffing compounds, scale, rust and other solids. If this occurs it should be taken care of by changing the cleaning practice.

Colloidal impurities, which are removable with activated carbon, can enter the bath from excessive addition agent, sizing in anode bags, compounds in rubber tank linings, precipitates from decomposition of chemicals, precipitates by reaction with hard water, and partial colloidal solution of stop-off materials. If such sources of contamination can be determined, it is often possible to avoid trouble by a change in practice or by the use of an alternative material. Such troubles are generally kept to a minimum by using plating quality materials recommended by sources of supply for the plating trade.

Rough Deposits

Rough deposits can be avoided by the use of filtra-

tion more than by any other means. However, there are other causes of rough deposits and it is necessary to recognize these in order to take the proper corrective steps in each case.

If rough plating occurs, a proper series of tests will indicate the corrective steps to be taken. If the roughness is due to suspended particles then it will disappear when the bath is filtered. If filtration cures the roughness problem, but it returns in a short time, then the indications are that the bath is being continuously contaminated. In such a case it is well to examine the anodes. Excessive anode sludge or a charged anode sludge can cause rough plating in a very short period of time. Bagging of the anodes becomes essential in such a case. On the other hand, if the anode sludge is due to anode films caused by excessive anode polarization, it is often possible to dispense with the inconvenience of bagging the anodes by increasing the anode area or by correcting the bath composition. If the trouble is continuous, anode bags should be used. If it is occasional, anode current density and bath limits should be considered. It is also possible that noble metal impurities can enter the bath and immersion plate on the anodes to cause temporary troubles.

If cathode rod agitation or other means of relative movement are used to obtain increased plating rates, then solid particles that would normally settle in a still plating bath will become a source of trouble. The bath movement will suspend such particles so that continuous filtration often becomes necessary.

Dirt on the work is a common cause of rough deposits. This is generally a trouble that has to be taken care of by a change in the cleaning practice. If such dirt is on the work at the plating step it will generally stay on the work, since it has survived the cleaning steps. It is not a source of contamination of the bath as much as it is a source of direct contamination of the work. Only if the work is excessively dirty will it cause sufficient contamination to result in rough plating of clean work that is processed later.

For some baths rough plating can be caused by

overplating of the work. Thick deposits are sometimes rough merely because they are thick. This is a matter of the characteristics of the particular bath used. For instance, it is difficult to obtain a smooth deposit greater than 0.002" thick from a copper cyanide bath by ordinary plating practice. A special procedure, such as periodic reverse plating, is the answer to such a problem.

High current densities can result in rough plating. In this case the limiting current density has been exceeded and it is necessary to reduce the total current or to reduce the current density in high current density areas by change in rack design, change of anode arrangement or by robbing or shadowing methods.

Low metal content in the bath will have the same effect at normal current densities as high current density with normal concentrations. In this case the plating range has been narrowed and the limiting current density has been lowered. Analysis of the bath will reveal the trouble.

Testing for Cause of Rough Deposits

It is not always possible to determine the cause of rough deposits, but it is possible to determine corrective steps to eliminate the trouble.

When unsatisfactory plating is obtained the best and fastest test is a simple plating test. This may be done by plating under standardized conditions on a panel hung in the bath or, preferably, by a standard plating range test. Standard tests of this type are: the inclined cathode or Hull test, the slot test, and the bent cathode test. These tests are preferred because they give definite reproducible information about the plating range of the bath. Such tests may indicate that a deficiency or possibly an excess of addition agent is causing the trouble. If the test is normal, but the production plating is rough then the cause may be due to suspended or colloidal impurities that do not show up for the usual short testing times of 5 to 10 minutes. If the roughness does show on the plating test, then a small portion of the bath may be filtered with laboratory equipment to determine if this will correct the trouble. In such an instance, testing of a filtered portion should show an improvement.

If plating tests are run specifically to test for trouble with filterable materials, longer time plating tests may

be more revealing. Also, a test specimen with a horizontal surface is desirable to allow suspended impurities to settle on such a surface. Rough plating on upper horizontal surfaces with smooth plating on the under surface and on vertical surfaces is a definite indication of trouble due to settling of solid particles.

Good practice in the use of plating tests is to run routine tests to establish a standard and to test before and after treating the bath. A complete procedure would be as follows:

1. Agitate bath to obtain a uniform sample.
2. Allow bath to settle so that solid particles that normally lay on the bottom will resettle.
3. Take a sample large enough for analyses and a plating test.
4. Run a routine plating test.
5. Compare the test panel to a record for a standard panel.
6. If the test is not normal adjust the bath to proper chemical limits using the results of the chemical analyses as a basis.
7. Run a plating test.
8. If the test is not normal, treat a sample of the bath for purification. This may be low current density electrolysis, chemical treatment, filtration, or treatment with activated carbon, followed by filtration.
9. Run a plating test on the treated sample.

By using a testing procedure it will be possible to determine chemical adjustment, addition agent control and bath treatment necessary to return the bath to normal plating. Such testing may also indicate the need for greater filtering capacity or for continuous filtering. If filtering is required on a laboratory scale to obtain satisfactory test results then filtering is required to obtain quality production plating.

Filtering Methods

A common method for filtering plating baths with a portable filter is shown in Fig. 1.

This method is generally used when the baths are small, when occasional filtering is satisfactory, and where a number of baths are filtered with one filter.

If continuous filtration is used, the filter is permanently piped to the plating tank, as shown in Fig. 2. This method is also used for occasional filtering. For

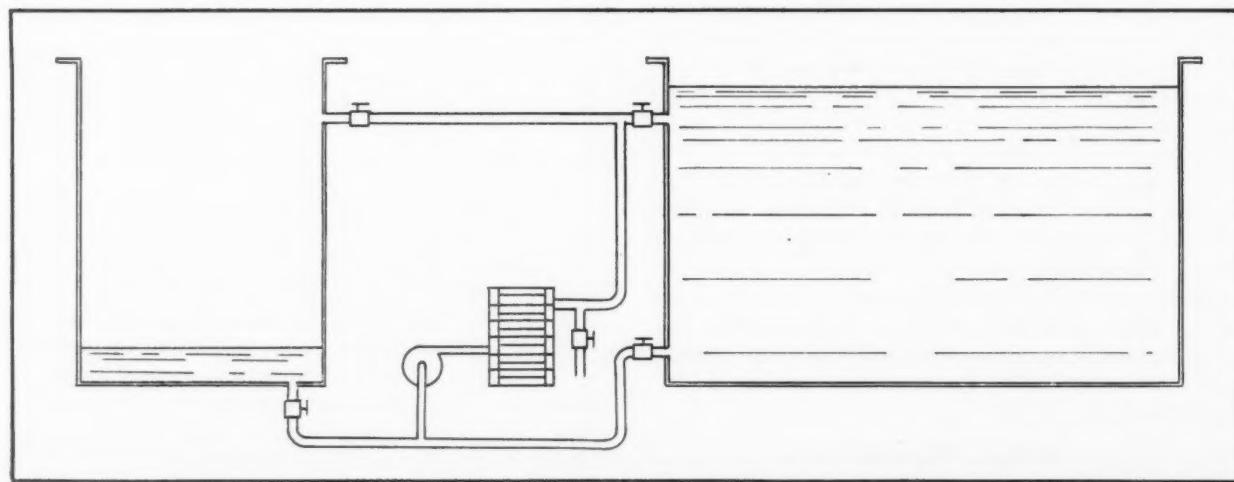


Figure 3. Slurry Tank Filtration.

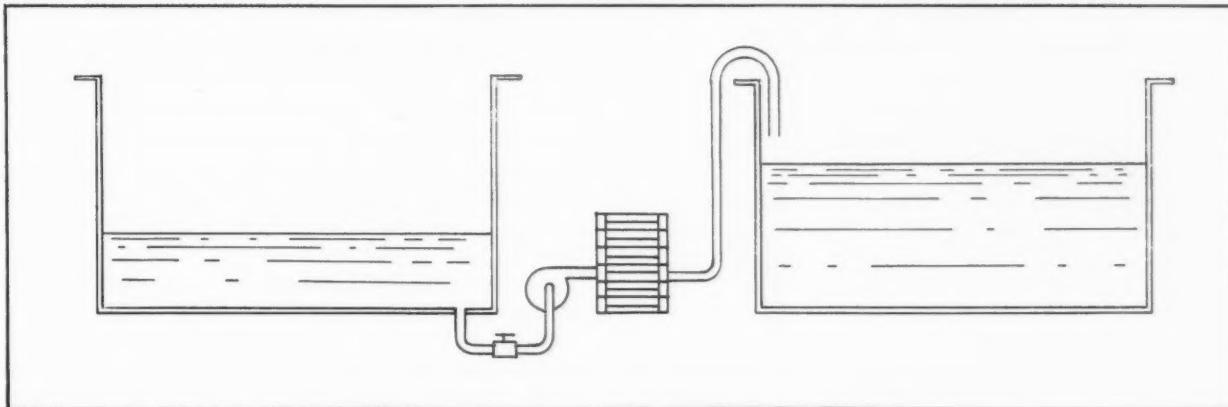


Figure 4. Batch Filtration.

such applications the filter is permanently installed and only operated when needed. With a permanent installation, savings in labor are realized. Also, if the filter is used only for one type of bath, frequent changing of the filter pads is avoided.

Fig. 3 shows a piping diagram for the use of a slurry tank. This method is used for charging the filter with activated carbon. Activated carbon is mixed with water or plating solution in the small tank. The slurry is pumped through the filter and back to the small tank until a cake of carbon is built up on the filter pads. The slurry cycle is then cut off and the plating cycle cut in and the bath is filtered through the carbon.

Fig. 4 shows batch type filtration. With this method the bath is only filtered once. With the proper filter medium passing of the bath through the filter once will be sufficient. The method is particularly good when it is desired to clean the tank of material too large to be removed by the filter, such as pieces of anodes and miscellaneous materials dropped in the tank.

Figs. 5 and 6 show a sump and batch-sump system, the latter for filtration of a number of baths by the use of one temporary storage tank.

The particular filtering method used will depend on the type of plating bath and the size and number of baths. If continuous filtration is required, a filter of proper size attached to each tank is the best answer. If occasional carbon treatment is also required then a slurry tank will also be used. The slurry tank may be permanent or portable, depending on the frequency of use.

If occasional treatment for a number of similar baths is required then the batch-sump filtration system is quite satisfactory. The sump tank should be a little larger than the plating bath. A slurry tank may also be used in connection with the sump tank. Also the tank may be used for electrolysis or chemical purification. In some installations, a sump tank and a temporary storage tank are used. When this system is used a bath can be removed from a plating tank to the sump tank and replaced with a reconditioned bath from storage. The bath in the sump tank can now be treated, analyzed, filtered, adjusted to proper limits and placed in temporary storage for reuse when needed. By the use of such a system, continuous batch reconditioning is possible with a minimum of down-time.

A general recommendation for the filtering rate is one tank volume per hour. Thus, for a 500 gallon tank the requirement would be 500 gallons per hour. The filtering rate will depend on the type of filter medium, the amount of solids to be removed, the size of the pipes through which the solution passes and the number of valves, elbows, and strainers in the pipe lines. The filtering rate will, of course, decrease as solid material is built up on the filter pads.

Table 1 shows the amount of removal of filterable material per tank volume. Approximately 60% of the material will be removed for every tank volume filtered on a continuous system. Thus if the rate is one tank volume per hour, 60% will be removed in one hour, 99% in five hours and 99.99% in ten hours. Five hours of filtration or five tank volumes should be sufficient, unless the bath is unusually dirty. Of course, with the batch system, passing the solution through the filter once is sufficient if the proper filter medium is used.

The Plating Baths

The type of filter and usual filtering practice for the various plating baths is shown in Table 2. Stainless steel filters are recommended for all of the acid baths. For the cyanide and alkaline baths, with the exception of silver, plain steel is satisfactory, although stainless steel is often preferred to avoid rusting when the filters are not in use. Stainless steel is recommended for silver because of the tendency of silver to immersion plate on plain steel under some conditions.

TABLE I
Filtering Rates for Continuous Filtration

Tank Volumes Continuously Filtered	Percent Filterable Material Removed
0	0
1	60
2	84
3	93.6
4	97.5
5	99.0
10	99.99

TABLE 2
Filtration of Plating Baths

Bath	Material of Construction for Filter	Usual Practice for Filtration
Cadmium-Cyanide	Plain Steel	Intermittent
Chromium	Stainless Steel	Occasional
Copper Acid	Stainless Steel	Continuous
Copper Cyanide-Rochelle	Plain Steel	Occasional
Copper Cyanide - High Efficiency	Plain Steel	Continuous
Iron	Stainless Steel	Occasional
Lead	Stainless Steel	Occasional
Nickel-Bright	Stainless Steel	Occasional
Nickel-Dull	Stainless Steel	Intermittent
Silver	Stainless Steel	Continuous
Tin Acid	Stainless Steel	Occasional
Tin Alkaline	Plain Steel	Occasional
Zinc Acid	Stainless Steel	Intermittent
Zinc Cyanide	Plain Steel	Intermittent

The usual practice for filtration is only shown in Table 2 to give an indication of usage of intermittent, occasional, and continuous filtration. It is not intended as a specific guide. Filtration practice will vary with a type of bath, depending on the thickness of the deposit and the quality desired. The practice for a specific bath will depend on the addition agents used.

Continuous filtration of five tank volumes per day would be ideal. However, this is not required in many cases and, unfortunately, cannot be used in other cases where filtration will remove colloidal addition agents.

Filtration will not always remove colloidal addition agents. This is obvious from the fact that activated carbon is required to remove colloidal impurities. With the proper filter medium it is sometimes possible to remove solids of harmful size and pass useful colloidal materials. Or, in other cases, the colloidal material is removed at a rate sufficiently slow that occasional additions to the bath can be made to replenish losses and maintain the plating range. In other cases, continuous filtration is an aid in removal of addition agents that polymerize to a harmful size. A specific practice can only be determined by trial or by advice of the supplier of a proprietary bath.

CADMUM CYANIDE:

Most cadmium baths are bright baths using proprietary addition agents. For thin deposits the baths have a fair tolerance for suspended impurities.

Occasional filtration is recommended to keep the bath clean. Less production time will be lost by occasional filtering of the bath and cleaning of the tank than by waiting until the bath is so dirty that production must be stopped. The major reconditioning required in the latter case, will consume considerable time.

Off-color deposits and loss of brightness in the cadmium baths result from contamination by soluble noble metals, from anode impurities, or other metals coming in contact with the solution. Such difficulties can be caused by thallium, lead, antimony, arsenic, tin and silver. These harmful metals can be removed by treatment of the bath with cadmium sponge, followed by filtration. The cadmium sponge will remove these metals by chemical displacement but, unless they are filtered off immediately, they will redissolve.

CHROMIUM:

Chromium has a high tolerance for dirt and suspended materials in the bath. This is due to the gassing at the cathode and the good cleaning qualities of the chromic acid.

Occasional filtering is recommended to clear the bath of excessive build-up of dirt and sludge that will take place with long usage.

ACID COPPER:

Acid copper baths are often used where heavy deposits are required. Because smooth deposits are required in order to obtain satisfactory heavy deposits, continuous filtration is recommended. If addition agents are used, one should be selected that will have sufficient life with the use of continuous filtration.

COPPER CYANIDE-ROCHELLE:

Due to gassing at the cathode and the cleaning power of this alkaline bath, the bath has a fair tolerance for dirt. However, the modern trend to heavier copper undercoats for nickel and chromium plating places a demand for high quality on the copper deposits. Due to this trend, filtration of copper cyanide baths is becoming a necessity. For thin deposits occasional filtration and cleaning of the bath is satisfactory.

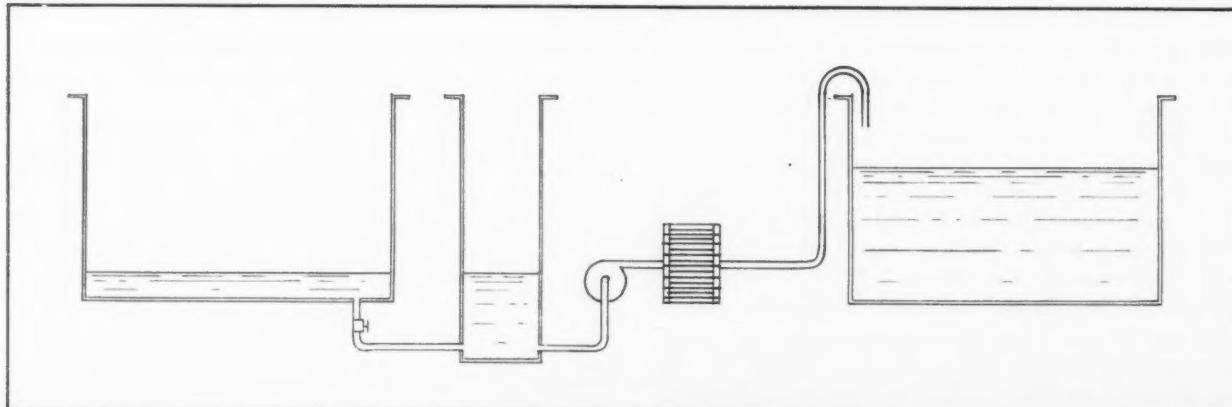


Figure 5. Sump Filtration.

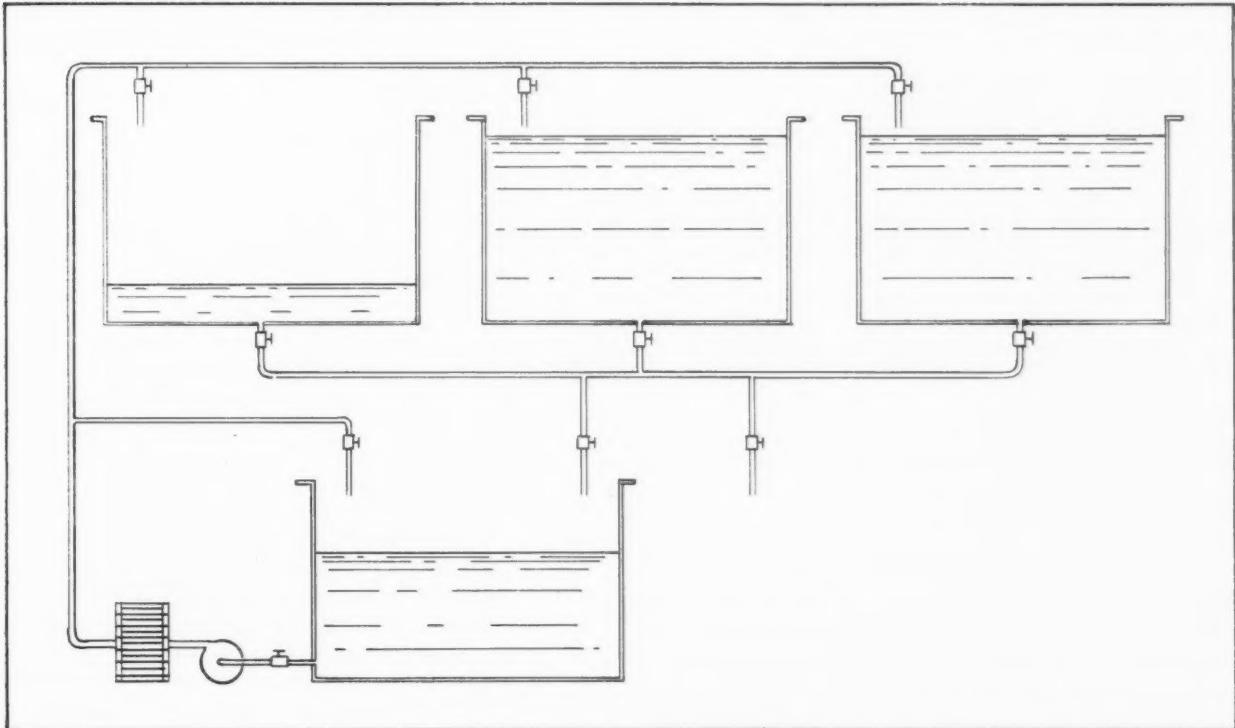


Figure 6. Batch-Sump Filtration.

Modified Rochelle baths or plain cyanide baths are used as strike baths. If ordinary water is used for make up, filtration of a freshly made bath is recommended to remove precipitates formed by the hard water. Such a filtered bath will function just as satisfactorily as a bath made with specially treated water.

COPPER CYANIDE-HIGH EFFICIENCY:

In order to obtain heavier, bright deposits at higher plating rates, the high efficiency copper cyanide baths are widely used. Agitation is used with these baths to obtain maximum efficiency. With agitation, impurities are kept suspended more than in the Rochelle baths. Also, anode sludge is more readily loosened and suspended in the bath. For satisfactory results continuous filtration is recommended. Bagging of the anodes, and tests with the bent cathode are also recommended to maintain the maximum filtering efficiency.

IRON:

Good control is required to obtain consistent results from the iron baths. Anode sludge and oxidation of iron salts are sources for formation of suspended impurities. Continuous filtration is recommended in some applications.

Some of the iron baths are highly corrosive so that, if they are operated at a high temperature, they may be corrosive to stainless steel. Consequently, periodic filtering is recommended for such cases.

LEAD:

Good lead or lead-tin deposits are relatively easy to obtain with proper addition agent control. Filtration is recommended since suspended particles will cause rough deposits.

Excessive addition agent or loss of addition agent control will cause rough deposits. If this happens, it is corrected by filtering through activated carbon.

BRIGHT NICKEL:

Proprietary bright nickel baths are widely used for decorative plating and as an undercoat for chromium. Continuous filtering is becoming more popular and periodic filtering is widely used.

Metallic impurities, such as iron, copper, and zinc, cause inferior deposits. Such impurities are generally removed by chemical precipitation, followed by filtration. Organic impurities also cause trouble so that filtering through activated carbon is a standard practice.

DULL NICKEL:

Dull nickel baths are operated in a manner similar to the bright nickel baths, except that addition agents are not used. Hydrogen peroxide treatment in conjunction with low current density electrolysis, activated carbon treatment, and filtering generally will restore a troublesome bath.

Iron is removed from nickel baths by oxidation with hydrogen peroxide, followed by precipitation by addition of nickel carbonate to raise the pH and finally filtering to remove the precipitated ferric hydroxide.

SILVER:

In many cases, silver baths are filtered continuously. Filtration will not remove addition agents and is essential to produce sound heavy deposits. For thin deposits, periodic filtering is satisfactory.

If excessive addition agent, such as carbon disulfide brightener, is causing trouble it can be removed by filtration through activated carbon.

ACID TIN:

Acid tin baths require good addition agent control and frequent filtering. Filtration may remove some of the addition agent affect, so that periodic filtering is

(Concluded on page 60)

Alkali Metals in Phosphating and Cyanide Plating Baths

Determination by Means of Anion Exchangers

By Gunnar Gabrielson, AB Tudor, Avdelning Harbeck, Partille, Sweden

Introduction

IN previous papers methods have been proposed for the determination of phosphate and accelerators¹ and metals² in phosphating solutions. According to the method described in the paper mentioned above,² the determination of the metals is performed in the following manner: ten ml of the phosphating solution are titrated with 0.1 N sodium hydroxide with methyl orange as indicator. Ten ml of the phosphating solution are also percolated through a layer of a strongly acid cation exchanger in the hydrogen form and, after washing the resin layer with distilled water, the combined effluent and wash water are titrated as before with 0.1 N sodium hydroxide against methyl orange. Since phosphoric acid is titrated as a mono-basic acid against methyl orange and, as the salts in phosphating solutions are mono-phosphates, the difference between the consumption of sodium hydroxide in these two titrations shows how many equivalents of metal ions are removed by the cation exchanger, i.e. the amount of metal ions in the solution. Because all cations are removed by the exchanger it is necessary to determine zinc separately in a zinc phosphate solution, e.g. through titration with a standard solution of potassium ferrocyanide,³ after which the content of sodium can be easily calculated from the titration values. Because the sodium content in this case is determined through differences between three titrations, the maximum error in the determination of sodium is estimated to 3 per cent.² Because of this, it seemed to be simpler and more accurate to perform the determination of sodium in phosphating solutions by means of an anion exchanger in the hydroxyl form, a method which can also be used for the determination of alkali metals in cyanide plating solutions.

Theory

An anion exchanger is, in principle, a high-polymeric, insoluble organic structure containing basic groups. The basic groups of the anion exchangers of weakly basic type are amino groups, primary --NH_2 , secondary --NH and tertiary --N , whereas the anion exchangers of strongly basic type contain quarternary ammonium groups, --NR_3^+ . As the strongly basic anion exchangers also have the ability of absorbing

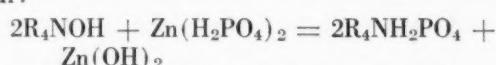
very weak acids, such as hydrocyanic acid, this type of resin was used in these investigations.

The reactions occurring when passing a salt solution through a layer of a strongly basic anion exchanger in the hydroxyl form can be schematically represented by the following equation:

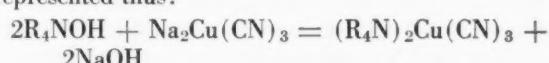


where R_4NOH is the anion exchanger in the hydroxyl form and MeA a salt of the monobasic acid HA.

Therefore, when a phosphating solution containing sodium nitrate or sodium chloride as accelerators passes the ion exchange layer, the following reactions occur:



In an analogous manner the reactions, when a cuprous cyanide solution containing an excess of sodium cyanide is percolated through the resin bed, may be represented thus:



As is seen from the above, the effluent after the anion exchange passage contains only sodium hydroxide which can be titrated with hydrochloric acid. At the passage of the phosphating solution zinc hydroxide is also formed as seen above but, as this compound is insoluble, it precipitates in the resin layer and cannot be detected in the effluent. From the titration the amount of alkali metal in the solution can be determined. This method has been used in the experiments described in this paper.

Apparatus

The experiments were performed with the strongly basic anion exchanger Dowex = 2 (manufactured by Dow Chemical Co.), with a particle size of 0.20-0.49 mm in air dry condition. The column was of standard type,⁴ with a height of 150 mm and a diameter of 10 mm of the resin layer. The ion exchanger was transformed into the hydroxyl form by passing 150 ml 1 N sodium hydroxide solution through the column and

subsequent washing with distilled water (about 200 ml) until neutral reaction of the filtrate was obtained. The flow-rate during regeneration and washing was about 3 ml per minute.

Experimental

PHOSPHATE SOLUTIONS:

The phosphating solutions used in these investigations were zinc phosphate solutions, which are often accelerated by sodium nitrate or sodium chlorate. Manganese phosphate solutions usually do not contain any accelerators, because of which these types of solutions were not investigated. The zinc phosphate solutions were prepared by dissolving zinc oxide in phosphoric acid, after which the accelerators were added. The chemicals used for preparing these solutions were of a high degree of purity, the content of sodium therefore being accurately known. The compositions of the solutions were taken from patents.⁵

Five ml of these solutions were passed through the anion exchange layer at a flow-rate of 3-4 ml per min. Afterwards, the resin was washed with 50 ml distilled water and the combined effluent and wash water titrated with 0.1 N hydrochloric acid with methyl orange as indicator. The choice of methyl orange as indicator instead of phenolphthalein depends upon the fact that the sodium hydroxide solution used for the regeneration has a tendency to react with the carbon dioxide in the air forming sodium carbonate, the anion exchanger after the regeneration, therefore, being partly in the carbonate form. Because of this, the effluent partly contains sodium carbonate instead of sodium hydroxide and it is necessary to use methyl orange as indicator for the titration. As zinc carbonate is only slightly soluble like zinc hydroxide, the possibility of the anion exchanger being in the carbonate form does not interfere with the analysis of zinc phosphate solutions.

The results of the analyses of phosphate solutions are shown in Table I, from which it is seen that the method gives accurate results, the maximum relative error being <0.5 per cent.

TABLE I

Solution No.	Accelerator	Grams per liter of sodium added	Grams per liter of sodium found	Relative error — %
1	NaNO ₃	4.00	3.99	-0.25
2	NaClO ₃	5.30	5.28	-0.38
3	NaClO ₃	6.48	6.51	+0.47

CUPROUS CYANIDE SOLUTIONS:

These solutions also were prepared according to the formulas in the literature for copper plating baths⁶ but with varying amounts of sodium cyanide added. The solutions were prepared by dissolving cuprous cyanide in an excess of sodium cyanide; in one solution sodium carbonate was also added. The chemicals used were very pure, the amount of sodium thus being accurately known. As before, 5 ml of the solutions were percolated through the resin layer at a flow-rate of 3-4 ml per min. and, after washing with 50 ml distilled water, the combined effluent and wash water were titrated with 0.1 N hydrochloric acid against methyl orange. The results of the analyses are presented in Table II

which shows that in this case also the maximum error was <0.5 per cent. It must be pointed out that copper could not be detected in the effluent.

TABLE II

Solution No.	Sodium added as	Grams per liter of sodium added	Grams per liter of sodium found	Relative error — %
1	Sodium cyanide	14.46	14.51	+0.35
2	Sodium cyanide	21.31	21.22	-0.43
3	Sodium cyanide + sodium carbonate	20.82	20.73	-0.43

ZINC CYANIDE SOLUTIONS:

The compositions of these solutions which correspond to zinc plating baths, were also taken from the literature,⁷ but in these solutions also varying amounts of sodium cyanide were added. Very pure chemicals were used in the preparation of the solutions, the amount of sodium, therefore, being accurately known. The solutions were prepared by dissolving zinc cyanide in a solution of sodium cyanide and sodium hydroxide.

As the zinc cyanide solutions used in these investigations were more concentrated than the phosphate and cuprous solutions, 10 ml of the zinc cyanide solutions were diluted with distilled water to a volume of 50 ml, 5 ml of this diluted solution was passed through the ion exchange column and, as before, the resin layer was washed with 50 ml distilled water. The combined effluent and wash water were titrated with 0.1 N hydrochloric acid. The results, presented in Table III, show that the accuracy in this case also is very high, the maximum relative error being <0.5 per cent. Zinc could not be detected in the effluent.

It must be pointed out that, in the passage of the resin layer by alkaline zinc cyanide solutions, no zinc hydroxide is precipitated as is the case at the passage of zinc phosphate solutions. The cause of this is that, in the alkaline zinc cyanide solutions, the zinc present is bound as complex zinc cyanide and zincate ions. The reactions at the passage of the anion exchanger are therefore:

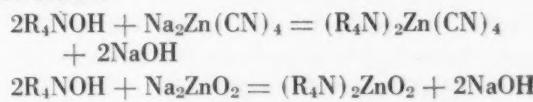


TABLE III

Solution No.	Sodium added as	Grams per liter of sodium added	Grams per liter of sodium found	Relative error — %
1	Sodium cyanide + sodium hydroxide	40.60	40.60	+0.0
2	Sodium cyanide + sodium hydroxide	45.00	45.20	+0.44
3	Sodium cyanide + sodium hydroxide	34.70	34.60	-0.29

Discussion

As is pointed out above, the method outlined for determining alkali metals in phosphating solutions is simpler than the method using a cation exchanger in the hydrogen form, which was described in a previous paper.² The method described in this paper also gives

more accurate values than the former method. The determination of the alkali metal content in phosphating solutions is very important, especially in the manufacturing control of concentrated phosphate solutions, from which phosphating baths are prepared through dilution with water. The analysis in this case is performed in the following manner: 10 ml of the concentrated solutions are diluted to 100 ml with distilled water; 5 ml of this diluted solution are passed through the anion exchange layer and the combined effluent and wash water are titrated with hydrochloric acid as described above.

The alkali metal content usually is not determined in copper cyanide and zinc cyanide plating baths, possibly because of the fact that sodium and potassium are rather difficult to determine by ordinary analytical methods. However, the method described in this paper is very simple and accurate for these metals. It must, of course, be of considerable interest to know the changes of all constituents of plating baths in order to know their manner of functioning. In order to determine the amounts of alkali metals present, the method outlined here seems to be very convenient.

It must be pointed out in this connection that, if more than one of the alkali metals are present, e.g. both sodium and potassium, the method described here gives the total amounts of alkali metals present; one of them must therefore be determined independently, after which the amount of the other can be calculated from the titration value.

As is seen above, the maximum relative error in the determination of alkali metals is <0.5 per cent, whereas, when using a hydrogen saturated cation exchanger for the determination of alkali metals in phosphating solutions, the maximum relative error was found to be 3 per cent.² This rather high maximum error is dependent upon the fact that the alkali metal content is calculated through differences between three titrations. The maximum titration error using methyl

orange was, in this case, estimated to be 1 per cent. When the titration is performed very carefully and proper amount of indicator is used, the maximum titration error must not exceed 0.5 per cent, which is shown in this paper.

Summary

1. A method has been worked out for the determination of alkali metals in phosphating solutions and cyanide plating baths.

2. Before the analysis, the zinc cyanide plating bath is diluted 5 times with distilled water. 5 ml of this dilution and 5 ml of the phosphating solutions and copper cyanide plating bath are passed through a layer of a strongly basic anion exchanger in the hydroxyl form (height and diameter of the resin layer are 150 mm and 10 mm respectively); afterwards, the resin is washed with 50 ml distilled water. Flow-rate during filtration and washing is 3-4 ml per min. The combined effluent and wash water is titrated with 0.1 N hydrochloric acid using methyl orange as indicator. As the effluent contains only alkali hydroxide, the amount of alkali metal is determined through this titration.

3. The method outlined here is very accurate, the maximum relative error being less than 0.5 per cent.

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FILTERS IN ELECTROPLATING

(Concluded from page 57)

generally used. Excess addition agent can be removed by filtering through activated carbon.

It is possible in baths of this type to use open filter media for continuous filtration in order to avoid removal of addition agents. In such a case, it may be desirable to filter occasionally with a fine filter medium.

ALKALINE TIN:

Alkaline tin baths have a high tolerance for suspended solids due to gassing at the cathode and the good cleaning power of the bath. In fact, the bath continuously forms insoluble tin compounds due to chemical decomposition. These settle on the bottom of the bath, forming a heavy sludge. Occasionally the bath should be removed from the tank and the sludge shovelled out. At such a time the bath can be filtered to remove the remainder of the solid material.

ACID ZINC:

Acid zinc baths are used where high efficiency and

low cost are factors. In continuous plating operations, continuous filtration is usually used. For still tank operation, where solids are allowed to settle to the bottom of the tank, intermittent filtration is satisfactory.

CYANIDE ZINC:

Zinc cyanide baths are very similar in characteristics to the cadmium bath. Impurities cause trouble and may be precipitated chemically as the sulfides or by the use of zinc dust. The precipitates may then be filtered off during normal filtration of the bath.

When to Use Filtration

Filtration is an economic control factor for many baths and many applications. The filtration method and frequency of filtration for a specific application are either determined on a basis of usage for similar applications or on a basis of experience and testing with the particular application. A great deal of experience has been accumulated as a guide to the probable need for a new application.

Anodizing Hollow Objects

By Wm. McNeill, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia, Pa.

AMONG the recent developments in magnesium finishing are several anodic processes which operate at relatively high voltages. Although these processes usually produce uniform coatings, the treatment of internal surfaces of hollow objects often presents a problem.

Current Distribution

With any of the high voltage processes, the voltage-time curve is similar to that shown in Fig. 1.

With a given bath, the properties of the coating depend on the voltage at the end of treatment, and it can be seen from Fig. 1 that, if the voltage were prevented from rising beyond some point below the normal finishing voltage, the net result would be the same as that due to insufficient treatment time. When hollow articles are treated, a voltage drop does occur at the openings to the interior. This is due to the resistance of the electrolyte and results in the voltage across the internal coating being less than that across the external coating. This difference increases as the internal surface area increases or the area of the openings and the conductance of the solution decrease.

With the A. C. processes, this difficulty has been overcome by using internal electrodes made of the same material as that being treated. These were connected to the bath terminal opposite the work. The internal electrode was anodized along with the work, and this of course wasted both electric power and bath chemicals. In addition, the problem of making connections to the bus bars became severe if more than a few items were to be treated in the same tank load. Another disadvantage of this technique was the burning of the work which resulted if contact between it and the electrode occurred.

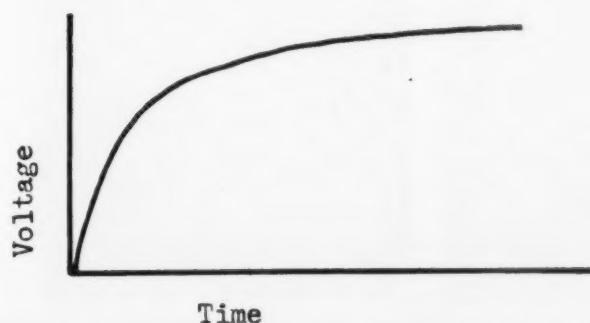


Figure 1. Voltage-time curve for high voltage anodic processes. Current density is constant.

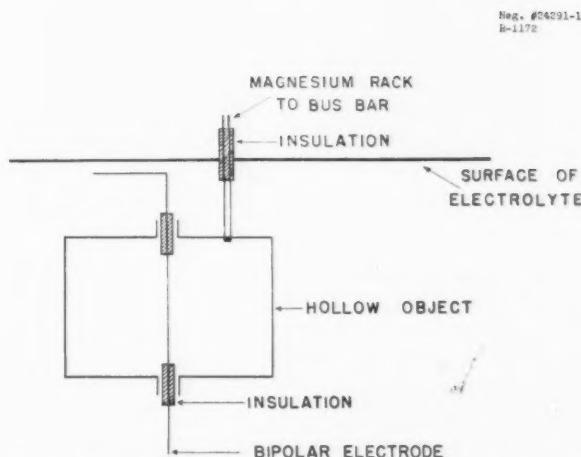


Figure 2. Diagrammatic sketch of bipolar electrode mounted in hollow object.

Bipolar Electrodes

Work at Frankford Arsenal has shown that the anodizing of internal surfaces can be greatly simplified by using a device similar to the bipolar electrodes used in electroplating.¹ It consists of a wire or strip of a suitable metal mounted in the opening to the interior of the hollow object. With the HAE process² copper wire has proven satisfactory. A schematic diagram of a bipolar electrode mounted in a hollow article is shown in Figure 2. The electrode is not allowed to contact the article directly, and is not connected to the bus bars. Its function is to provide a low resistance path for the current flowing to the internal surfaces. Figure 3 shows two magnesium boxes prior to HAE treating. The boxes were made of FS-1 alloy sheet 0.10" thick, and were cubes measuring 6" on each edge. In each box were 2 holes having a total area of 1½ in.² A copper wire electrode is mounted in the larger opening of the box on the left. A similar electrode appears in the center foreground. Figure 4 shows the coating on the interior of two boxes and the exterior of a third. No bipolar electrode was used in treating the box on the right and a mottled coating resulted. If treatment had been continued long enough to give a uniform internal coating, that on the exterior would have been non-uniform. Tests with the HAE process have shown that a bipolar electrode that exposes 10 in.² of copper surface on each side of the opening is ample for 1½ ft.² of internal surface. These tests were conducted using FS-1 alloy. For any of the magnesium alloys containing rare earth metals, slightly greater electrode area is needed. For tubing, a single strand of wire (14 gauge

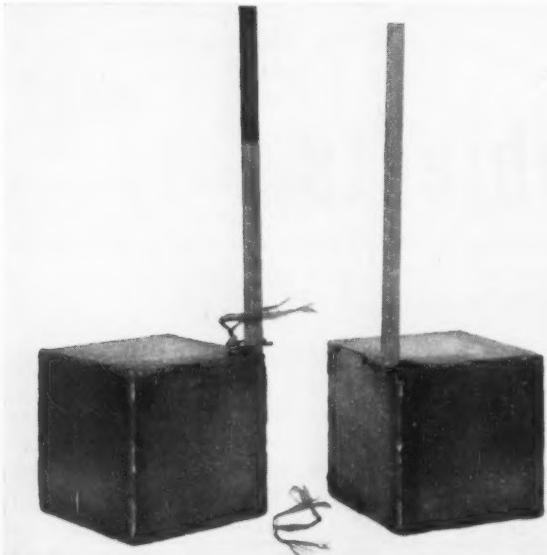


Figure 3. Untreated magnesium boxes. At left, box equipped with bipolar electrode; center, copper wire electrode; at right, box without electrode.

or larger) which exposes as much copper surface inside as outside the tube is satisfactory.

Bipolar electrodes made of lead solder wire were found to improve the internal coating of aluminum tubes anodized in sulfuric acid. Two tubes of 24-S alloy measuring 24 in. in length and 1 in. I.D. were anodized in 15% sulfuric acid at 85°F. The ends of the tubes were plugged with rubber stoppers, each of which had one hole $\frac{1}{4}$ in. in diameter cut through it. A piece of lead solder wire 3/32 in. in diameter and 48 in. in length was inserted in one of the tubes so that 24 in. of wire surface was exposed both inside and outside the tube. After anodizing, the tubes were sawed lengthwise and the dielectric strengths of the internal and external coatings on both tubes were measured (see Table I). The internal coating of the tube equipped with a bipolar electrode gave approximately the same value as the external coatings on the two tubes. The internal coating of the other tube was found to give approximately half this value.

In mounting the bipolar electrodes, care must be taken not to obstruct the openings to the interior so much that escape of gases is prevented. During anodizing, one opening should be at the uppermost part of

TABLE I
Dielectric Strengths of Anodic Coatings
on Aluminum Tubes (Volts)

	External Coating	Internal Coating
Anodized using Bipolar Electrode	345	332
Anodized Using No Bipolar Electrode	314	162

the article to prevent the formation of gas pockets.

The metals used in constructing bipolar electrodes must be selected carefully and will depend on the bath in which they are to be used. The metal should be compatible with the electrolyte. For example, aluminum wire is not used in the HAE process because it would be attacked by the highly caustic bath. Similarly, copper wire is not used in dichromate baths but steel wire has proven satisfactory.

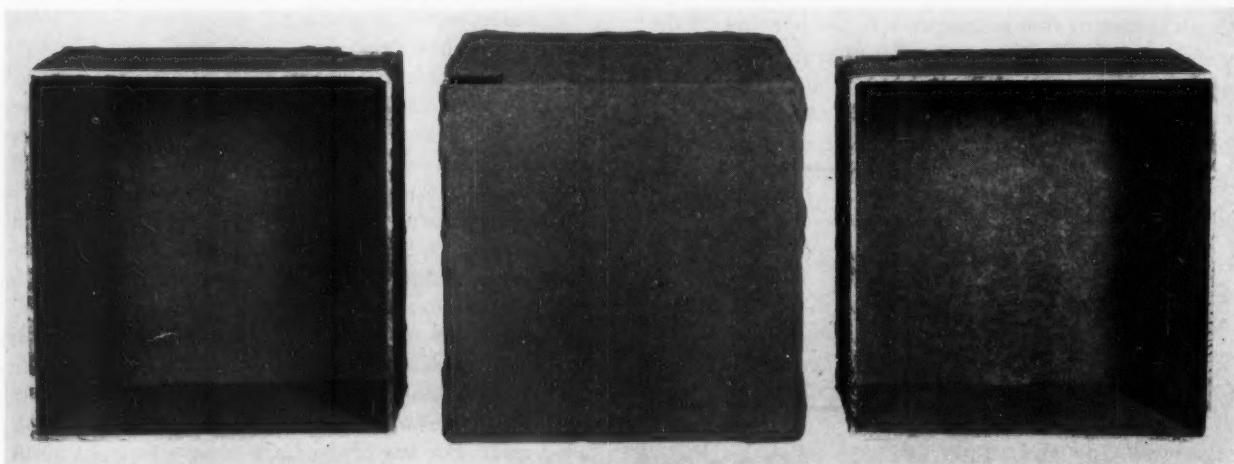
Some metal-electrolyte junctions have abnormally high electrical resistance and this must be considered in the construction of bipolar electrodes. Aluminum in solutions of borax or magnesium in certain solutions containing fluoride exhibit this barrier effect. Copper, steel, and lead are free of this effect in the solutions most frequently used for anodizing magnesium and aluminum.

Our experience at Frankford Arsenal has shown that bipolar electrodes offer the simplest and most economical means of anodizing hollow or deeply recessed articles. Electric power and bath chemicals are not wasted and racking time is less than with other methods. Bipolar electrodes are safer in operation because they do not contact either the bath terminals or the articles being treated.

It is hoped that the information given here will be of value to those who may have problems in finishing internal surfaces of magnesium and aluminum. The author is indebted to the Ordnance Corps for permission to publish this article and to Dr. G. F. Nordblom for several helpful discussions.

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Copper wire bipolar electrode used.
Normal external coating.
No internal electrode used.
Figure 4. HAE treated magnesium boxes.

Metal Cleaning with Ultrasonics

By Melville Morris, President, Circo Equipment Company, Clark Township (Rahway), N. J.

SOUND, to most of us, is anything we hear. To the physicist, it is a form of vibrational energy. Technically, sound consists of a series of condensations and rarefactions (waves) which are produced by a vibrating body, pulsating at sonic frequencies. The range of sounds audible to the human ear is from twenty to about twenty thousand vibrations per second. This is sonic sound; all sound waves above the audible range — specifically, frequencies higher than about eighteen thousand or twenty thousand cycles per second — are called ultrasonic.

Sir Isaac Newton who has achieved immortal fame for many of our laws of physics should also be given credit for laying the foundations of the theory of sound. In a few words it was this: "The more elastic the medium (gases, liquids, metals, etc.) through which the vibrations are carried, the faster they travel. Also, the denser the medium, the slower they travel, provided the elasticity is held at a constant value." This law has given us the basis for the scientific study of sound as vibration.

Most of us can remember the fascinating phenomenon of the great singer Caruso shattering a wine glass with his voice. It was obvious to all this was some form of energy. The field of sonic energy has hardly been explored but, to date, most of us are familiar with "ultrasonic smoke precipitators." Recently an Australian firm brought on the market an ultrasonic home laundry machine. Now we have an ultrasonic dental drill and special operations in machining and cutting are performed with ultrasonic energy. This article will confine itself to ultrasonics used specifically for metal cleaning.

Sound waves can be produced in many ways. In metal cleaning, the sound waves are produced by instruments called transducers. These transducers are brought into action by the influence of electricity supplied by a generator. The favorite transducers at the present time are magnetostriction vibrators (at frequencies below fifty thousand cps), quartz crystals (at frequencies between two hundred fifty thousand and one million cps) and polarized polycrystalline ceramics notably barium titanate (at all frequencies). These solid bodies change their dimensions under the influence of electricity. When electric current flows through the transducer, it is magnetized and becomes shorter. When current ceases to flow, the transducer becomes longer again. The electrical excitation must conform to the natural frequency at which the given transducer material stretches and shrinks, for only in this way

can a high output be achieved with a power supply of economical proportions.

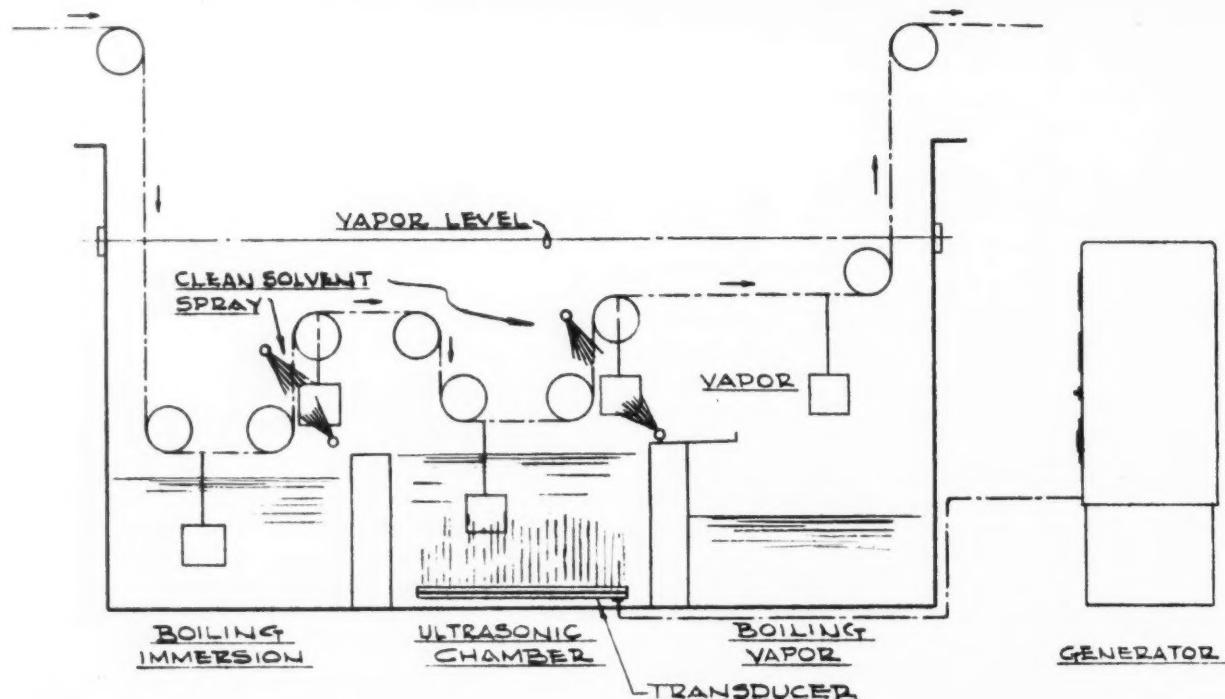
As these transducers expand and contract they propel sonic energy with tremendous force in liquid layers at certain frequencies and intensities at which these transducers are designed to operate. Therefore, it is possible to set up pressure fluctuations of considerable magnitude. The liquid is torn apart, bubbles of empty space come into being. But then the positive pressure phase returns and the cavities collapse violently. This activity occurs over and over again at the frequency determined by the motion of the transducer. This process just described is called cavitation and this action against the metal parts subjected to it gives them a scrubbing which they could receive by few other methods.

In general, the part to be processed is immersed in a cleaning solution for a brief period (as little as ten seconds) during which time it is subjected to ultrasonic vibrations. Either organic solvents or alkaline solutions can be used in this process. Most machines produced to date have used the chlorinated hydrocarbons, trichlorethylene or perchlorethylene, due to their unique characteristics and other obtainable features aside from the ultrasonic process. This technique has been remarkably successful in removing minute particles of dust, dirt, and chips, which are not affected by conventional cleaning methods. The ultrasonic action penetrates into deep crevices and removes dirt, oil, grease, chips, lapping and honing compounds, as well as microscopic particles of soil, more thoroughly than any other process, including hand brushing.

The first ultrasonic cleaning machine was demonstrated at the American Society of Metals Exposition and Congress in Philadelphia October 1952. This machine, while small in size, would efficiently clean small intricate parts such as hypodermic needles, ball bearings, electric shaver heads. The results of this type of cleaning were so obvious that rapid progress has been made during the past two years in the field of metal parts cleaning with ultrasonic equipment.

There are now available, as standard equipment, ultrasonic units in the following ranges: 500 watts, 2 KW, 10KW and 25 KW. They are so designed they can be adapted to many existing degreasing machines with liquid immersion stages. They are also designed so that they can be incorporated into the standard two and three dip liquid immersion vapor degreasing equipment of most manufacturers. This is, indeed, a tremendous step forward in the field of metal cleaning.

Large production of many size parts can also be



handled. There are being manufactured crossrod conveyors, monorail conveyor equipment as well as standard hand operated conventional equipment. The cost of adding an ultrasonic chamber to a conventional piece of metal cleaning equipment is very inconsiderable.

Probably the latest development has been the design and introduction of barium titanate flat transducers. Barium titanate has been the most economical and most efficient type transducer to use both from the standpoint of construction, cost and operation. However, it has always been necessary to produce these barium titanate transducers in concave shapes so that the energy could be focused to obtain maximum intensity. Considerable research and experimentation has shown the engineers how to design barium titanate transducers that can be driven at high watt density per square inch at lower frequencies so that the cleaning areas are now considerably broadened. Most any size flat transducer can be manufactured and there are available as standard equipment flat transducers over 20" long. This is certainly a great stride from the two and three inches that could be cleaned previously and places barium titanate way ahead in desirability over quartz crystals and the higher cost magnetostrictive type.

The accompanying schematic diagram illustrates the general theory to the application of ultrasonic energy for metal cleaning. Parts are precleaned in the proper cleaning cycle using immersion, spray, vapor, or any combination thereof prior to the ultrasonic chamber. The parts are then submitted to the ultrasonic action to remove the last vestige of contamination either on the surface or in the recesses of the parts being cleaned.

It has also been determined that the lower the frequency the greater the penetrating ability. This is important when removing tripolis, rouges, and other contamination which is relatively thick.

Barium titanate transducers are polycrystalline ceramics, molded into any desired shape and fired in a furnace. They operate at low voltage. A slab of barium titanate prepared by firing, consists of many small crystals which are lined up in all directions. Before the slab will operate as a transducer, the small crystals must be lined up in the same direction. This is done by placing the slab in a strong electric field — a process similar in many ways to that of making a permanent magnet — and is known as polarization.

Ultrasonic cleaning now promises to revolutionize the technology of removing oil, dirt, grease, and chips from metal parts. The revolution, in fact, has already begun. Items as diverse as ball bearings, vacuum tube elements, sewing machine parts, clock motors, pump and valve fittings, hypodermic needles, automobile parts, compressor heads are now being washed cleaner than ever before and at a lower cost and in much less time by the simple process of dipping them into an appropriate solvent and subjecting them to ultrasonic action. In a work piece of irregular shape, the cracks and crevices which are inaccessible by all the usual methods come out clean when treated by this process.

Ultrasonic cleaning seems utterly simple to a casual onlooker, who never fails to be amazed at the startling transformation wrought in the surface appearance of a greasy strip of metal, inserted for just a moment in the sound field.

The future of ultrasonics in metal cleaning can be summed up by quoting an executive of a prominent automotive manufacturer: "Conventional cleaning methods that were entirely adequate for most purposes would on occasion pass over the minute particles of dust, chips, or dirt left clinging to these parts. Ultrasonics provided the answer to the difficult problem of making the cleaning complete. Ultrasonic cleaning is used before final assembly and the result is a finished product of superior functional accuracy and increased service life."

Descaling and Pickling Titanium

By John Starr, Los Angeles, Calif.

RESEARCH work recently completed by Ryan Aeronautical Company at San Diego, Cal., has disclosed a number of satisfactory processes for descaling and pickling titanium — new "wonder metal" of the aircraft industry.

Such processes are especially important in work with titanium because the latter oxidizes more or less readily at temperatures exceeding 800°F. — temperatures that are essential to the annealing, welding, and hot forming of the metal. Even where inert gases are employed, as in fusion welding, it is virtually impossible to exclude air to such an extent that no oxide formations will be produced on titanium surfaces.

In general, oxide formations on titanium can be classed as "light" if they are produced at temperatures of less than 1000°F.; "heavy" if they are produced at higher temperatures.

Experience at Ryan has shown that some titanium surface conditions cannot be satisfactorily corrected, but can be avoided if certain precautions are taken before the materials are processed with heat. For instance, mill stencil markings can be readily removed with a solvent-soaked rag before they are hot formed or annealed; and, if this isn't done, the markings are likely to be etched in the material surfaces following heating and pickling operations.

Similarly, titanium parts should be vapor degreased prior to heat processing in order to avoid the formation of scale which will produce a rough surface following a pickling operation.

Where the above precautions were observed, heavy oxide formations have been satisfactorily removed by:



Descaled titanium materials, removed from a salt bath, get a cold water quench as shown here.

(1) Sodium hydride processing in a conventional manner for 1 to 5 minutes, and immersing in a pickling solution comprising 40% nitric acid by volume (38° Bé) and 3% sodium fluoride by weight at an ambient temperature.

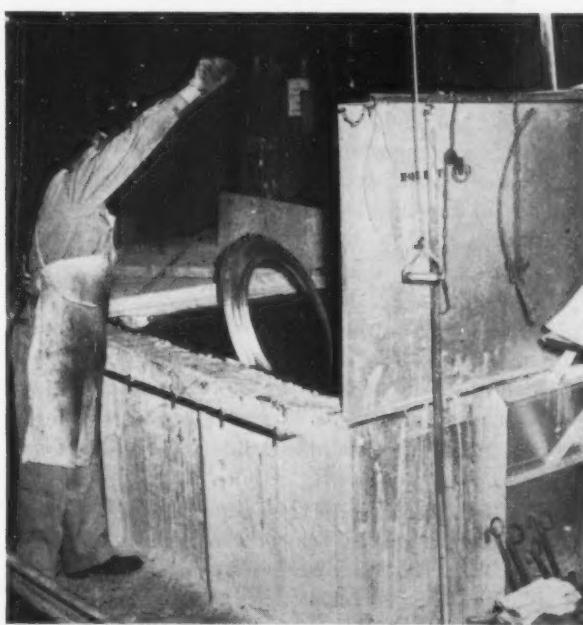
(2) Proprietary molten bath processing at 800°F. for 20 minutes, and immersing in the above pickling solution.

(3) Processing for 30 minutes in an aqueous salt bath comprising (by weight) 47% sodium hydroxide, 9% sodium nitrite, 6% sodium nitrate, and 38% water at a temperature of about 300°F. This is followed by the same pickling operation that is indicated for the two processes above.

The titanium parts should, of course, be quenched with cold water after they are removed from a salt bath and rinsed with water sprayed under high pressure after they are pickled.

Titanium materials with light oxide coatings have been satisfactorily cleaned by immersion for 20 minutes in a 40% nitric acid, 3% sodium fluoride pickling solution alone. However, such processing usually had to be preceded by a dezincing operation where the materials had been formed with zinc-plated or zinc-alloy tools.

Where slight etching was required to facilitate subsequent resistance welding, Ryan has processed titanium parts with light oxide coatings in a pickling solution comprising 5 to 10% sulfuric acid (by volume), 1.5 to 3% sodium bifluoride (by weight), and 0.75 to 1.5% chromic acid (by weight) for 1 to 5 minutes at an ambient temperature. Metal losses due to the use of the latter solution average about 0.001" per hour.



Titanium components with heavy scale formations are processed in a salt bath, as indicated here.

Surface Treatment and Finishing of Light Metals

Part V. — Chemical Conversion Coatings (II.)

By S. Wernick, Ph.D., M.Sc., F.R.I.C., F.I.M. and R. Pinner, B.Sc.

ANOTHER German process developed by the Vereinigte Aluminum Werke A.G. is the L.W. process,⁸ in which disodium phosphate is added to the M.B.V. solution. This process is similar to one or two processes developed by a British Company in 1936.

The Pylumin Process

Two processes are claimed in the patent⁹ specification, one of which, like the L.W. processes, employs an addition of disodium phosphate to the M.B.V. solution, while the other uses a carbonate of a heavy metal, also as addition to the original M.B.V. bath. In practice, only the carbonate bath is at present employed.

The Pylumin process is claimed to have two substantial advantages over the M.B.V. process:

- It does not need to be discarded when exhausted but losses in bath constituents are made good by regular additions;
- It is claimed to give satisfactory coatings on alloys containing heavy metals, e.g., duralumin-type alloys. Apart from this, the process has the usual advantages and disadvantages inherent in the proprietary process.

The fact that the solution does not require frequent renewal is an important one in plants which process large quantities of work and the process is in extensive use in England, at one time being employed to protect 3½ million sq. ft. of aluminum surface per week.

The coating, like the M.B.V. is grey colored, the shade depending on the alloy composition. On the copper-containing alloys it is frequently non-uniform in color, and the process finds by far its greatest application as a base for organic finishes.

The coating is not suitable for dyeing for decorative purposes.

The Pylumin solution is the original M.B.V. solution with the addition of a heavy-metal carbonate, which does not react with the sodium carbonate present in the solution. Iron carbonate may not be used for this reason. The carbonates may include those of chromium, nickel, cobalt, manganese or titanium, and two

examples of solutions given in the patent specification comprise:

	Per cent
(1) Sodium carbonate	5.0
Sodium chromate	1.7
Basic chromium carbonate	0.5
Water	92.8
	Per cent
(2) Sodium carbonate	7.0
Sodium chromate	2.3
Basic chromium carbonate	0.5
Sodium hydroxide	0.5
Water	89.7

Of these, solution (1) is worked at a gentle boil for 3 to 5 minutes, while solution (2), which contains free sodium hydroxide and a higher total salt concentration, is suitable for operation at 70°C.

The concentration of the constituents, as in the M.B.V. solution, is not critical and good results may be obtained under a wide range of operating conditions.

As has been noted above, a second process, not frequently used, contains disodium phosphate similar to the L.W. process, and a typical solution contains:

	Per cent
Sodium carbonate	6.0
Sodium chromate	2.0
Disodium phosphate	0.2
Water	91.7

this solution being worked at 90 to 100°C. for 3 to 5 minutes. While a more recently patented solution contains:

Sodium carbonate	4.8% (wt.)
Potassium permanganate	0.5-3%
Chromium carbonate	2.3-5%
Disodium phosphate	0.5%

Control of the Pylumin solutions is carried out by simple chemical analysis. The alkalinity is determined by titration against standard acids and the solution replenished by means of the original salts.

As it is used mainly as a paint-base, the coating is not sealed. A cold-water rinse followed by a hot-water rinse is the normal treatment after the coating is completed.

TABLE I
Ten Months' Exposure Tests on Unpainted Aluminum and Pyluminized Aluminum Panels
5 in. x 2 in. x 16g.

	Aluminum Unprotected		Pyluminized Aluminum	
	I.	II.	I.	II.
Initial weight (g)	28.3318	28.1358	27.8840	28.7286
Loss in weight on stripping (g)*	0.2812	0.2688	0.1840	0.2012
Loss in weight in per cent	0.992	0.956	0.659	0.701
Loss in weight in mg./dm. ²	0.218	0.208	0.142	0.156

*The loss in weight due to corrosion was determined by stripping ten panels in 70 per cent nitric acid. A 15 min. immersion was necessary, after which they were lightly rubbed with a rag while they were being rinsed under the cold-water tap. The weight of the Pylumin coating determined on similar panels was approximately 0.015 gm./dm.²

TABLE II
Corrosion Resistance of Painted Aluminum with and without Pylumin Treatment

Hours salt spray	Painted	Pyluminized-painted
610	Unaffected.	Unaffected.
654	Paint blistering from scratch.	Unaffected.
785	More blistering from scratch and some general blistering.	Trace of very slight blistering.
829	White corrosion in scratch.	White corrosion in scratch, isolated blistering.
941	Further blistering with paint lifting from scratch.	Slight isolated blistering spread.
1183	Heavy general blistering and further paint lifting from scratch.	No change.
1683	Blistering slightly intensified.	Small blisters intensified.
2258	Blistering further intensified with some general paint lift.	Slight blistering spreading at edges.

Tables I and II give some results of salt-spray tests on Pyluminized aluminum.

Alrok Process

This process is similar to the M.B.V. process, though it has some patented features, developed possibly from an early Pacz process.³² The solution contains sodium carbonate and potassium dichromate and is operated at near boiling point for about 20 minutes, the solution composition varying, however, with the alloy composition and whether cast or wrought products are treated.

The general range of composition of the Alrok solution is:

	Range of Composition	Normal Composition
Sodium carbonate	0.5 to 2.6%	2.0%
Potassium dichromate	0.1 to 1.0%	0.5%

The coating obtained by this process is about the same thickness as the M.B.V. and is grey or green depending on alloy composition and operating composition, due to the chromium oxide in the coating.

In both wear resistance and corrosion resistance the coating is similar to the M.B.V. film. Alrok films, however, similarly to anodic films, are usually sealed in hot dichromate solution and the comparative corrosion resistance of different coatings is given in Table III. These results have been compiled from the change in mechanical properties of 24 ST (H-15) panels after eight weeks' exposure to salt spray (3.5% NaCl) and

the change computed from comparison with panels not exposed to corrosive influences.

TABLE III
Effect of Salt Spray on 24 ST (H-15) Panels

Treatment	Percentage change (after eight weeks' exposure to 3.5% salt spray)	
	Tensile Strength	Elongation
Untreated	-12	-66
Alrok, unsealed	-12	-62
Alrok, dichromate sealed	-1	-20
Chromic acid anodized	0	-6
Sulphuric acid anodized, unsealed	0	-1
Sulphurized acid anodized, dichromate sealed	+1	-1

A process has also been developed by the Aluminum Company of America,²⁶ by which the dull grey coating produced by the Alrok process or certain anodizing processes, may be whitened. For this purpose, the work is immersed in a solution containing nitric acid or a mixture of nitric acid and sulphuric acid, where concentration is not critical. Typical solutions of this type contain: 35% (wt) nitric acid or a mixture of 25% nitric acid and 25% (wt) sulphuric acid. The bath may be used hot or cold, and a permanent dense, adherent, white coating is claimed to be obtained.

Like the M.B.V. film, the Alrok coating may be sealed in waterglass²⁷ solution of a silica: soda ratio ($\text{SiO}_2:\text{Na}_2\text{O}$) of preferably over 3:1. Potassium silicate ($\text{SiO}_2:\text{K}_2\text{O} > 4:1$) may also be employed. The optimum concentration of the waterglass should be approximately 5.0% and the solution is kept at between 80 to 100°C.

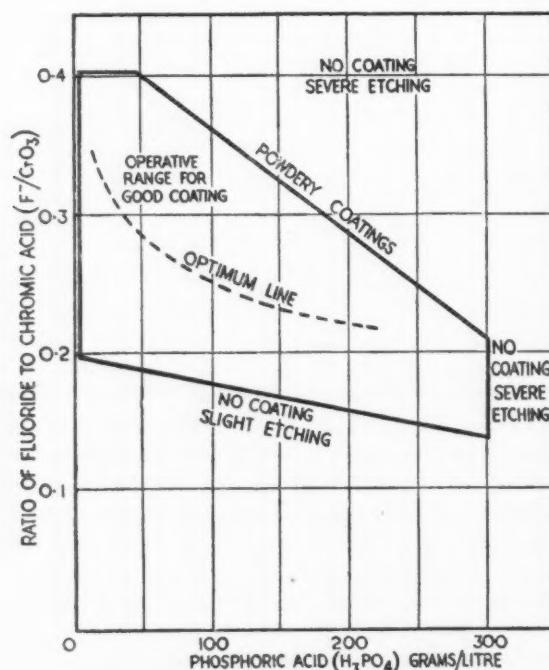
Alternatively, and this is the usual procedure, the coating is sealed in a solution of chromate or dichromates,²⁸ or chromic acid.²⁹ A chromic acid solution, worked at 20°C. for 10 minutes is suitable, the coating then being dried without rinsing. Care must be taken not to heat the solution, as above 35°C. the coating is liable to be attacked by the chromic acid. Dichromate solutions are, in general, preferable to chromate, as twice as much hexavalent chromium is absorbed by the oxide film. The solution is operated at between 80 and 100°C. and must not contain free chromic acid. Experiments on anodic coatings have shown that the silica seal was a little inferior in corrosion resistance to the dichromate seal.

Alrok coatings may be dyed similarly to M.B.V. films. After sealing in dichromate, the coating is yellow in color, and may be dyed brown by immersion in silver nitrate. A red color is obtained by immersion in uranyl acetate solution, followed by potassium ferrocyanide, while immersion in cadmium acetate solution followed by ammonium sulphide, produces a yellow color.³⁰

The Alodine and Alocrom Processes

A recent development in chemical oxidation processes in the U. S. A. is the Alodine process developed by the American Chemical Paint Company, which was introduced in Britain by I.C.I. Ltd., as the Alocrom process.

In contrast to the M.B.V. type processes, the new treatment makes use of an acid solution containing



Operating range chart using alkali-fluoride, chromic acid and phosphoric acid.

chromates, phosphates, and fluorides* within the range shown in the diagram.

The optimum range of the solution is:

	g. per liter
PO_4^{---}	20 to 100
F^-	2.0 to 6.0
CrO_3	6.0 to 20
	(F^-)

while the ratio of fluoride to chromic acid _____



lies between 0.18 and 0.36 with an optimum value of 0.27. If the phosphate content is too low, i.e., below 6 g./L., the concentration of fluoride and dichromate becomes critical and control of the solution is difficult. If, on the other hand, the fluoride:dichromate ratio is too high, the coating is non-adherent and the surface is etched. No coating is formed if the ratio is too low.

The total acidity should not exceed 3N and, for this purpose, all polybasic acids where the second ionization constant is less than 10^{-4} are considered as monobasic. If the acidity is too high, powdery, non-adherent coatings are formed or the metal may be etched.

No reliable pH measurement has been found possible, due to the oxidizing effect of the dichromate on indicators, and hydrogen and quinhydrone electrodes, and the effect of fluoride on the glass electrode. The commercial pH meter with a glass electrode is used, however, and the final nearly steady pH reading, or the lowest value indicated within the first 10 minutes are taken. This should be preferably between pH 1.7 and 1.9.

The cations present in the solution are important only as buffers. Aluminum, trivalent chromium, zinc, copper, manganese, iron, nickel, cobalt, calcium, barium, strontium, tin, sulphate, nitrate, acetate and chloride may be present in reasonable quantities without harm to the coating. Reducing agents are harmful as they cause loss of dichromate by reduction to trivalent chromium. Many of the commercial alloys have been coated satisfactorily.

Examples of solutions given in the patent specification are shown in Table IV.

The consumption rates of the ingredients are approximately:

F^- (g.)	1.0
CrO_3 (g.)	0.7 to 1.4
Acid (g. equivalents replaceable hydrogen)	0.06 to 0.14
PO_4^{---} (g.)	0.5 to 1.0

Acid is consumed, with hydrogen evolution, by attack on the metal; phosphate and fluoride are included in the coating and dichromate is consumed by reduction to trivalent chromium, some of which is included in the coating. Fluoride is also lost by precipitation as aluminum, fluoride and, to a lesser degree, as chromic fluoride, when the solubility limit of these compounds is reached with increase in aluminum and trivalent chromium content. Some chromic phosphate may also be precipitated.

*U. S. Pat. 2,438,877, Can. Pat. 452,254. F. S. Spruance, Jr.

TABLE IV

	I. g./L.	II. g./L.	III. g./L.	IV. g./L.	V. g./L.	VI. g./L.
Phosphoric acid (75%) (H_3PO_4)	64	12	24	—	—	—
Sodium dihydrogen phosphate ($NaH_2PO_4 \cdot H_2O$)	—	—	—	31.8	66.5	31.8
Sodium fluoride (NaF)	5	3.1	5.0	5.0	—	—
Aluminum fluoride (AlF_3)	—	—	—	—	—	5.0
Sodium acid fluoride ($NaHF_2$)	—	—	—	—	4.2	—
Chromic acid (CrO_3)	10	3.6	6.8	—	—	—
Potassium dichromate ($K_2Cr_2O_7$)	—	—	—	10.6	14.7	10.6
Sulphuric acid (H_2SO_4)	—	—	—	—	4.8	—
Hydrochloric acid (HCl)	—	—	—	4.8	—	4.6

The coating loses 40 per cent of its weight on heating and becomes increasingly corrosion resistant after dehydration by this means. For example, the coating before heating is soluble in 70 per cent HNO_3 , but after heating is only sparingly soluble in the boiling acid.

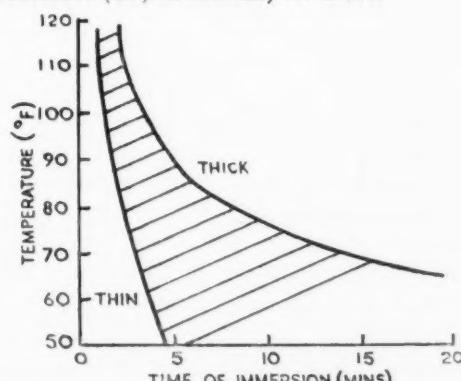
As in the case of the Pylumin process, there are no details as yet available of the composition and thickness of the Alocrom coating, though it is probable that the latter consists mainly of aluminum and chromic oxides, and a proportion of chromate, phosphate and fluoride.

The Alodine coating usually contains approximately:

Chromium	18.20	per cent
Aluminum	5.5	"
Phosphorus	15.17	"
Fluorine	0.2	"

While the composition of the film dried at low temperature is:

Chromic phosphate	50.55	per cent
Aluminum phosphate	17.23	"
Water	22.33	"
Fluorides (Cu, Cr and Al.)	traces	



Effect of operating time and temperature on coating thickness for Alodine process.

One of the advantages of the process is that it can be applied at room temperature, 65°F., in the short time of five minutes, though the operating time can be cut to 1½ minutes if the temperature is raised to 120°F.

After treatment, the work is rinsed in cold water for 10 to 15 seconds, after which the work is immersed for 10 to 15 seconds in a 0.05% solution of chromic acid or phosphoric acid ("Deoxylyte" rinse) which is kept at 100 to 120°F. The work is then dried at 100 to 150°F.

The Alocrom solution is contained in a stainless steel tank, and racks, hooks or baskets should also be of stainless steel, or, alternatively, aluminum, in which

case they are replaced from time to time. Heating is by stainless steel steam coil or by means of a gas-heated water jacket. The temperature should not exceed 120°F. and a thermostat should be used. If heated, the tanks should be fitted with exhausts, as in all solutions containing chromic acid. As distinct from the alkaline processes, work must be cleaned before the Alocrom treatment. A vapor degreasing stage, or solvent immersion-type cleaner, is sufficient. During operation a sludge forms, which settles to the bottom of the tank. This is removed when necessary, by decantation.

The coating produced by the treatment is thin and hard and is an attractive light bluish-green with slight iridescence on copper-free alloys, and an olive-green on copper-containing alloys. The color is not guaranteed, however, for any particular alloy, as it is dependent on the operating conditions. If the coating becomes too light in color, however, this can be corrected by raising the temperature, lengthening immersion time or making the bath more concentrated. Powdery surfaces are obtained when the work is not properly cleaned, when traces of alkali remain on the work, when the solution is too hot, too strong or when treatment is too long, when the acid rinse is contaminated or its temperature is too high, or when the temperature of drying is too high.

Alternatively to the immersion process, the solution may be applied in a power-spray machine when the time required is only approximately 20 seconds. This process is recommended for strip metal.

The Hot-Dry Process

This is a modification in which the work is removed from the Alocrom bath and allowed to drain thoroughly, removing all draining beads from the edges with a rag or clean compressed air. The work is then baked at 280 to 350°F. until dry — normally for approximately two minutes.

The coating produced by the hot-dry process, which is comparable to a "self-sealing," is of an attractive gold color and is superior in corrosion resistance. While the standard method is used as a pretreatment for paints, the hot-dry process is employed for unpainted work. Should it be required to paint aluminum treated by the hot-dry process, the baking should be followed by the acid rinse, and a much hotter drying temperature can be used.

Control of the solution is by chemical analysis, in which the solution is titrated against standard sodium hydroxide, using bromocresol green as indicator.

Other Chemical Oxidation Processes

Many other processes are available for the chemical oxidation of aluminum, the majority of which are not, however, in widespread commercial use. Only those processes which are of commercial importance will be described here.

JIROTKA PROCESS

This is an old Swiss process,³¹ producing an oxide coating containing a thin, metallic layer, which may be partly oxidized, depending on the length of treatment.

Several types of bath may be used:

(1) An acid solution containing dilute nitric acid and 0.5% of a salt of zinc, chromium, nickel or copper, with or without the addition of an alkali chromate. This solution is worked for 20 to 60 minutes.

(2) A solution of 5% potassium permanganate containing also 2% hydrofluoric, sulphuric, or acetic acid, 5% sodium chromate and 0.5% of heavy metal salt. The coating produced by this rather complex solution contains manganese dioxide and chromic oxide as well as aluminum oxide, the film color depending on the kind and concentration of the chemicals employed. In some solutions, the acid is replaced by a mixture of 1.2% hydrogen peroxide and 2% sodium dichromate. These solutions are operated at room temperature.

(3) Alkaline solutions, containing 5% of sodium or potassium carbonate or hydrocarbonate, with the addition of 1% of a heavy metal salt. Five % potassium dichromate or glycerine is sometimes added to this solution to produce a bright, metallic lustre. The coating may also be darkened by the addition of potassium permanganate. The alkaline solution is worked hot.

PACZ PROCESS

The Pacz process^{32, 33, 34, 35} is American in origin and, like the Jirotko process, is an early development whose present-day use is of limited application, due chiefly to the complexity of the solution and the lengthy time of treatment required.

The coating produced by the process is rather harder than the usual oxide coating, and is obtained by immersion in a solution containing:³³

Sodium fluosilicate, oxalate or fluozirconate	0.15%
Sodium or ammonium nitrate	0.25%
Nickel or cobalt salt	0.3 %

The coating is, however, rather patchy in color, due to the etching effect of the fluosilicate. Certain alloy constituents may not be attacked and remain dark.

The solution is operated at 70 to 100°C. for 20 to 60 minutes.

PROTAL PROCESS

This process^{36, 37, 38} has its principal application in France, and consists of immersing the work for 40 minutes in a boiling solution of 0.5% of an alkali manganate, molybdate or vanadate with the addition of 1% sodium hydroxide or sodium carbonate. The anion present and the metallic compound produced, form two oxides, the higher one being alkali soluble, the lower insoluble. The lower oxide is codeposited with the aluminum oxide coating due to reduction by the hydro-

gen produced at the solution-metal interface. The operating time may be reduced by the addition of an alkali phosphate,³³ the aluminum being precipitated as the phosphate effectively removing the hydrogen and preventing the formation of a hydrogen blanket which inhibits the reaction.

McCULLOCH PROCESS

This process involves immersing the work in a solution containing:

Calcium hydroxide	1%
Calcium sulphate	1%

which is operated at 70 to 100°C. for one hour. Alternatively, calcium in this solution may be replaced by strontium.

The coating on pure aluminum is white in color, or green in the case of several alloys. When hydrogen evolution has ceased, the treatment is completed and the work is washed and heated to 200°C. This dries off the water from the film and increases the electrical resistance. Barium may be used to replace the other alkaline-earth metal, in which case half the concentration should be employed. The coatings produced by this means are uniform and of a silvery-grey color.

RECENT V.A.W. PROCESSES

Two further processes have been developed by the Vereinigte Aluminium Werke A.G. during the last war.

In the first of these⁴⁰ the work is immersed in an ammoniacal solution, containing approximately 0.01% alkali chromate, operated at 70°C. for 20 to 50 min.

The coatings obtained by this process are lustrous and grey white spotted, very hard and similar to enamels, the exact color design varying with the state of the surface.

The coating is very much harder than either the M.B.V. or E.W. films, hardness tests giving the following comparative results:

Load (in g.)	0.75	1.25	2	3
Hardness of E.W. coating, (Width of scratch)	2.9μ	3.8μ	4.5μ	5.3μ
Load (in g.)	4	5	6.55	8.0
Hardness of coating from ammonia-chromate bath: (Width of scratch)	3.4μ	4.7μ	5.6μ	6.5μ

Bath control is by analysis, or alternatively, by addition of iron chromate, whose solubility at 70°C. is 0.01%, avoiding the need for strict control. Care must be taken not to increase the chromate content above this figure, as excess chromate will inhibit the reaction.

In the second process,⁴¹ metal is first cleaned by etching in concentrated nitric acid, or is hand cleaned, after which it is immersed for 35 to 40 min. in a solution containing ammonia and an alkali persulphate operated at 70 to 80°C. An example of this type of solution contains:

Ammonium hydroxide (0.91)	214 ml./L.
Ammonium persulphate	10 g./L.

which is operated at 80°C. for 35 min.

Another solution of this type is worked at 70°C. for 40 min. and contains 50 g./L. ammonium persulphate in a 3% solution of ammonium hydroxide. The coatings obtained by this method are clear and transparent and no sealing is required.

Of the vast number of the chemical oxidation processes suggested and patented, space here permits mention of only a small number. A more or less complete list of processes will, however, be found in the bibliography at the end of this article. It must not be assumed that all or even a large part of these processes have actually come into widespread commercial use. Many of the solutions suggested are too complex to be handled economically, several others, like the Jirotnka and Pacz, are mainly of historical interest as the time required to form the coating is lengthy and not normally competitive with simpler and quicker-acting processes. Many different types of solutions will form protective coatings on aluminum. It depends on the economics of the process, not less than on the properties of the coating, whether a particular type of treatment is suitable for commercial application. A lengthy, expensive treatment though perhaps producing a coating which is superior to other oxide coatings, may find itself in economic competition with the various anodic oxidation processes which, up to now, have proved far superior in chemical and physical properties to any produced by chemical means.

Application in Organic Finishing

One of the most important applications of chemical oxide coatings is as a base for paints, enamels, etc. For this purpose, the coating should be porous rather than dense and should, of course, not be sealed.

Similarly, an undercoat is often unnecessary, and may indeed in some cases be harmful. Preferably, the oxide coating is dried in an oven or by direct heat at 100 to 120°C.²⁴ The M.B.V.-type coatings are also a good base for baking lacquers, as the firing temperature may be higher without losing adhesion, thus leading to better chemical properties of the lacquer. The lacquer coating must not, however, be too thick. M.B.V. films also prevent "under-coating" of corrosion if the organic coating is damaged.

The function of the oxide coating as a paint base is, however, far from clear. Contrary to established opinion, J. D. Edwards and R. I. Wray⁴² believe that the paint-holding character of the coating is due not so much to the absorptive capacity of the film as to its inert and non-reactive character. The pores may, in fact, be so fine that large microcells may be unable to penetrate the coating, which, nevertheless, is still an excellent paint base. This theory is supported by electrical theories of adhesion in which it is shown that the nature of the bond of the paint-to-oxide coating is superior to the paint-to-metal bond.

In addition to the effects of chemical inertness and paint-absorption, the effect of the chromic oxide present in the film is largely similar to that of chromate paint primers, and helps in repairing and maintaining the oxide coating without appreciably increasing the thickness of the film. The absorptive oxide coating on aluminum may be given greatly increased protective value by absorbing chromate into the pores and decreasing the porosity.²⁸ This applies particularly to the Alrok coating which, sealed in dichromate solution, is a rather better paint base than the silicate sealed M.B.V. coating.

Although not so good as a paint base, E.W. coatings

have still been satisfactorily lacquered. H. Wolf and H. Tuxhorn⁴³ lacquered aluminum-copper-magnesium alloys of the duralumin type after E.W. treatment and waterglass seal, with excellent results. The lacquer was applied by immersion and dried very rapidly, only 5 g. per sq. meter of lacquer being retained on the surface. The alloys in their clad condition were also lacquered with success, though in this case the increase in corrosion resistance obtained was not quite as high.

As mentioned above, many workers in the M.B.V. process prefer longer immersion times and high temperatures to obtain maximum porosity and absorptive capacity in the use of M.B.V. coatings prior to paint finishes. If this method is used, it is often an advantage to dry the coating for 30 min. at 100 to 150°C. to evaporate all free moisture from the oxide film. Lacquers are best burnt in. As against this, R. P. Marshall,¹³ working with aluminum castings, containing bronze inserts, recommends only a 3 to 4 min. treatment in the M.B.V. solution and subsequent spraying of the paint. The coating was not sealed, nor was an undercoat applied under cellulose lacquers.

In this section, the influence of chemical oxide coatings on the paint-bond and the corrosion resistance has been dealt with. It must be emphasized, however, that no chemical oxide treatment can turn a bad paint into a good one and, in general, the effect of the oxide coating on the corrosion resistance is often less pronounced than the quality of the paint.

Electrodeposits on Oxide Coatings

From the principle that aluminum may be electroplated on top of a modified anodic coating, Helling and Neunzig^{44, 45} developed a process of copper plating on the M.B.V. coating. An acid copper solution was employed, containing:

Copper sulphate	150 g.
Sulphuric acid (65%)	60 g.
Gelatin	0.01 to 0.1 g.
Water	1,000 ml.

This is operated at room temperature (20 to 25°C.) for 60 min., using a current density of 1.0 to 1.1 amp. per sq. ft. Copper deposits on M.B.V. coatings on duralumin were porous and unsatisfactory.

Good results were also obtained, according to these authors, with copper deposits on coatings produced from solutions containing sodium metavanadate, e.g., by the Protal process. An etching operation in the plating cycle was unnecessary.

The copper deposits obtained possess a small electric resistance. Their corrosion resistance, however, depends on the alloy composition, heat-treatments, etc. A recommended operating sequence is: 10-min. immersion in sodium-hydroxide solution — neutralize in 2% hydrochloric acid — 15 min. M.B.V. treatment — acid copper plating. Such copper deposits were frequently lacquered to improve their maximum corrosion resistance, particularly for warm-moist atmospheres.

Heavy-Metal Inserts

An important application of chemical oxidation lies in the treatment of aluminum on alloy castings containing inserts of heavy metals. Such work can be anodized only if the foreign metal can be effectively

TABLE V
Corrosion Resistance of Coated Aluminum Alloy with Heavy-metal Inserts

<i>Alloy</i>	<i>Carbon-steel insert</i>	<i>Treatment</i>	<i>Appearance</i>	<i>Loss in weight after 200 hours salt spray %</i>
195	Bare	1	Moderate corrosion round insert	0.426
		2	Light general corrosion	0.308
	356	1	Moderate corrosion round insert	0.422
		2	Moderate corrosion round insert	0.278
40E	40E	1	Moderate corrosion round insert	0.396
		2	Light corrosion round insert	0.189
195	Zinc plated	1	Light corrosion round insert	0.089
		2	Light corrosion round insert	0.032
	356	1	Light corrosion round insert	0.060
		2	Discoloration round insert	0.045
40E	40E	1	General discoloration of panel	0.057
		2	General discoloration of panel	0.045
195	Cadmium plated	1	Light corrosion round insert	0.026
		2	General discoloration of panel	0.012
	356	1	Light corrosion round insert	0.026
		2	Discoloration round insert	0.023
40E	40E	1	General discoloration of panel	0.013
		2	General discoloration of panel	0.012

*1—Samples treated with aluminum part coupled to heavy metal.

2—Aluminum part treated before assembly.

masked, as otherwise the current will short through the inserts, not only decreasing the current density at the aluminum surface to a point where no oxidation takes place, but also pitting and dissolving the insert itself. Masking is an extra operation and has to be applied to each article separately, sometimes at considerable expense. Chemical oxidation of such work, on the other hand, can be carried out without trouble, provided that the surface of the insert is not large compared to the aluminum surface. As will be seen, mixed metal surfaces, of a large heavy metal: aluminum surface area ratio, are most effectively protected by a phosphate treatment.

Numerous workers have investigated the chemical oxidation of aluminum with heavy-metal inserts and it will suffice here to give a brief example of some of the investigations carried out by A. J. Ferko,⁴⁶ who applied the Alrok process to the American alloys 40E, 195 and 356. Samples of these alloys were coupled with carbon-steel bolts, nuts and washers, some of which were cadmium or zinc plated, before treatment, and then disassembled, the aluminum alloy being weighed and the samples reassembled. Additional treated as well as some anodized samples were weighed and coupled separately to bare and plated carbon steel. All the samples were then salt sprayed, according to the standard process (Fed. Spec. AN-QQ-S-91) for 200 hours, after which they were disassembled and their corrosion products removed by alternate soaking in water and ethyl alcohol with intermediate brushing. The specimens were then washed in alcohol and reweighed to determine loss

in weight due to corrosion. Some results of these investigations are given in Table V.

Treated aluminum samples not coupled with inserts showed no corrosion after 200 hours' salt spray, while samples which were anodized after coupling to the heavy metal showed poorer corrosion resistance than those protected by the Alrok process.

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SHOP PROBLEMS

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

High Speed Silver Plating

Question: We are setting up to silver plate the inside of a short tube for corrosion protection and a deposit thickness of at least 25 mils has been specified for this particular job. During the war, we read about high speed silver plating processes which were used for aircraft bearings requiring about the same thickness of silver as our tube. Could you suggest a suitable formula and operating conditions for this type of production? We are figuring on rotating the tubes vertically for agitation purposes, which we know to be necessary. Would another method of agitation be more advisable?

M. W.

Answer: A suitable high speed silver bath contains the following:

Silver cyanide	14 oz./gal.
Potassium cyanide	18 "
Potassium carbonate	4 "
Caustic potash	4 "

This solution is operated at 100-120 deg. F. and current densities up to 100 amp./sq. ft. are possible with suitable agitation. In addition to rotation of the tubes at about 100 to 200 r.p.m., we would suggest that the solution itself be agitated by pumping up from the bottom through a perforated pipe or from a pipe with nozzles set to discharge into each tube. Because of the elevated temperature, carbon disulfide brightener is not advisable. Ammonium thiosulfate or one of the proprietary brighteners for silver are preferable.

Source of Patents

Question: We occasionally read one of your patent abstracts in Metal Finishing which interest us and would like to obtain more information.

How can we obtain the complete details?

M. G.

Answer: Copies of United States patents are obtainable from the Patent Office at 25 cents each. Address requests to Commissioner of Patents, Washington 25, D. C., enclosing payment and listing the patent number.

Finishing Costs

Question: I am a job polisher and would like some information as to the price relationship between operations, such as polishing and plating. I am working with a plater and I feel that he doesn't allow me enough for polishing, while he thinks I am getting too much for polishing. Is there a way to determine how much should be allowed for each operation, when we charge 5 cents each for a bracelet, for example?

D. C.

Answer: There can be no generalization or comparison between relative costs of polishing and plating operations. Ordinarily, job platers and polishers will figure about three to four times their direct labor cost as their selling price. To this is added the value of precious metals used for plating.

Wood Nickel Solution

Question: We would appreciate any information you may have on the "Woods Nickel" solution for plating aluminum. We have heard of the solution and would like information for the makeup and maintenance.

M. A.

Answer: The Wood nickel solution, so far as we are aware, has not been employed for plating on aluminum. Its application has been to stainless steel and other nickel or chromium

alloys, such as Monel; also to bronzes, where good adhesion of deposit is required.

The solution consists of 2 lbs. nickel chloride and 1 pint muriatic acid per gallon. Nickel or carbon anodes are used, at room temperature and 6 volts for about 20-60 seconds.

Brass Color on Aluminum

Question: We are brass plating small aluminum switch terminals in the same mechanical brass solution in which we plate small steel parts. It seems that after every two or three batches, the brass solution gets off-color when we plate the steel pieces. It gets so we have to do a lot of manipulating of the solution to bring it back to a brass color again.

We would like to know if there is some kind of a dye resembling brass, bronze or copper that we could dip the aluminum pieces in and, at the same time, must not stop the current carrying qualities of the aluminum terminals.

J. D. G.

Answer: Chromate conversion coatings may give you a satisfactory color. Your plating supply house may be able to furnish you with samples of their products for trial, or you can have some of your parts treated by one of the companies who advertise such processes in METAL FINISHING.

Gold or brass colored dyes might also be suitable for your application. Such dyes are obtainable from Eaton Chemical & Dyestuff Co. and Sandoz Chemical Works, Inc.

Barrel Nickel Plating

Question: Our wire pins are thoroughly degreased to almost white color, copper plated, then polished to a very high degree. The copper polished pins are plated with tin or nickel and the result is sent in two pkts. "A" (tin) and "B" (nickel) for your perusal. Another sample "C" is also sent to you for comparison and you will please observe the difference in plating and color. The bluish white plating in "C" is very attractive and

we shall be obliged if you can give us some guidance how we can obtain such results. The sample "C" is a product of some other manufacturer. Please also let us know if cadmium or recently developed tin-nickel alloy plating can produce such better results.

S. P. L.

Answer: The dark color or barrel nickel is whitened by additions of cobalt sulfate in amounts of about 1 oz./gal. The white finish is also obtained from the newer types of hot bright nickel plating barrel processes, which are available from manufacturers advertising in METAL FINISHING.

Cadmium would present a hazard, since pins are very often held between the lips. Tin-nickel alloy has a pinkish cast and would not duplicate the samples furnished.

"Hardware Finish"

Question: We would like to know what the term "hardware finish" means and how it is obtained for use on zinc based die castings.

R. W. P.

Answer: The term "hardware finish" is very indefinite but refers to furniture and builders' hardware. It would be necessary to know which particular finish is desired. For example, Commercial Standard CS22-40 of the U. S. Dept. of Commerce for Builders' Hardware lists 29 standard finishes ranging from paint through most of the commonly plated metal finishes, polished, blasted, brushed, oxidized and relieved.

Peeling Nickel Plate

Question: I would appreciate having any information to eliminate peeling of nickel plate from steel (low carbon). I have tried all the common steps: reverse and direct cleaning, double rinse, double pickle (etching), hydrochloric acid, double water rinse. Our nickel solution is a Watts type.

K. W.

Answer: Peeling of nickel plate from carbon steel, assuming the plating solution is in good condition, would be due to defective cleaning procedure or a film on the steel. We would suggest that you communicate with the company from which you purchase your cleaner for assistance, since the problem cannot be handled by correspondence.

There is a section on cleaning of

carbon steel for plating in the METAL FINISHING Guidebook, from which you might obtain some pointers, and a very complete article on the subject of peeling appeared in the April and May, 1953 issues of METAL FINISHING by Richards.

Gold Engraving on Guns

Question: We have call for finishing our engraved guns as follows: black oxide finish on the parts not engraved and gold plate the engraving. We have seen jobs like this but are puzzled as to how to do it. We do quite a lot of gold plating over a nickel undercoating and, of course, do gun bluing but how to do this job is too much for us. We need help on this

and if you cannot help us, can you refer us to the highest authority on it?

D. W.

Answer: To produce the gold plating in the engraving of the guns, stop-off all but the area to be gold plated. Then clean, nickel and gold plate as usual. The nickel and gold are removed from the highlights with a hard felt wheel or a belt sander with a metal platen. The gun can then be blackened as usual by the caustic black process without affecting the gold in the recesses.

Instead of stopping-off the parts which are to remain black, you might find it more practical to apply the nickel and gold to the engraved areas by brush plating.

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**Recently Granted Patents
in the Metal Finishing Field**

Patents

Abrasive Blasting

*U. S. Patent 2,682,135. June 29, 1954.
W. I. Gladfelter, assignor to Pangborn Corp.*

In blast treating apparatus, in combination, a bin for storing blastant material in particle form, blastant particle projecting means, means providing a circuit for delivering blastant particles from said bin to said projecting means and for returning projected particles to said bin, means for receiving blastant stock in continuous form and for severing the same into particle form and delivering the severed particles to said circuit, means for feeding blastant stock in continuous form to said severing means, and means responsive to the level of blastant particles in said bin for initiating and terminating operation of said feeding and severing means.

Electropolishing Aluminum

*U. S. Patent 2,682,502. June 29, 1954.
F. H. Hesch, assignor to Kaiser Aluminum & Chemical Corp.*

A method of brightening aluminum surfaces comprising subjecting the surface as anode to an electrolytic treatment in an electrolyte consisting essentially of from about 0.1 to 0.8% HF, from 0 to about 2.0% H_3BO_3 and from about 0.05 to 0.5% CrO_3 , balance substantially all water, said percentages being by weight of the total solution.

Electropolishing Aluminum

*U. S. Patent 2,682,503. June 29, 1954.
F. H. Hesch, assignor to Kaiser Aluminum & Chemical Corp.*

A method of brightening aluminum surfaces comprising subjecting the surface as anode to an electrolytic treatment in an electrolyte consisting essentially of from about 0.1% to 0.8% HF, from about 0.05 to 0.4% HSO_3 NH_2 and from about 0.3 to 2.1% CrO_3 , balance substantially all water, said percentages being by weight of the total solution.

Belt Polisher

U. S. Reissue Patent 23,846. July 6, 1954. H. D. Coe, Jr. and J. B. Dym.

A device for finishing a workpiece of irregular shape, comprising two wheels, mounting means for each of said wheels for mounting said wheels in spaced relationship, each wheel rotatable about its axis relative to its mounting means, means for supporting the mounting means for one wheel movable relative to the other mounting means so that the axis of said one wheel may be moved relative to the axis of the other wheel, an endless abrasive belt having an abrasive surface and extending around said two wheels, an endless drive belt having a portion extending from one to the other wheel in face-to-face engagement with said abrasive belt and having another portion spaced from said abrasive belt, said driving belt exerting a force on said movable mounting means tending to urge said axis of said movable wheel toward the axis of said other wheel, means associated with said movable mounting means tending to counteract said force, means cooperative with said driving belt for setting said wheels at a predetermined distance from each other, and a form block disposed between said wheels at a place where said driving belt is spaced from said abrasive belt, said form block having a matrix surface substantially conforming with the surface to be finished in male and female relationship and engageable by one surface of said abrasive belt when a workpiece is held against the other surface of said abrasive belt.

Gas Plating

*U. S. Patent 2,682,702. July 6, 1954.
A. O. Fink, assignor to The Commonwealth Engineering Co. of Ohio.*

A multi-layer metal product which is resistant to blistering and separation of the layers upon heating of the metal product at elevated temperatures

comprising an aluminum metal base, a thin layer of nickel adhered to said aluminum base by exposing the base to an atmosphere of gaseous carbonyl formed from nickel and having a thickness of between about 0.00001 and 0.00025 inch, said thin layer of nickel being of greater porosity than said aluminum metal base and having the gas desorbed therefrom, and a second layer of nickel disposed over said thin porous layer by exposing said thin layer to an atmosphere of gaseous carbonyl formed from nickel, said second layer being substantially greater in thickness and higher in density than said thin layer of nickel.

Stripping Deposits from Iron

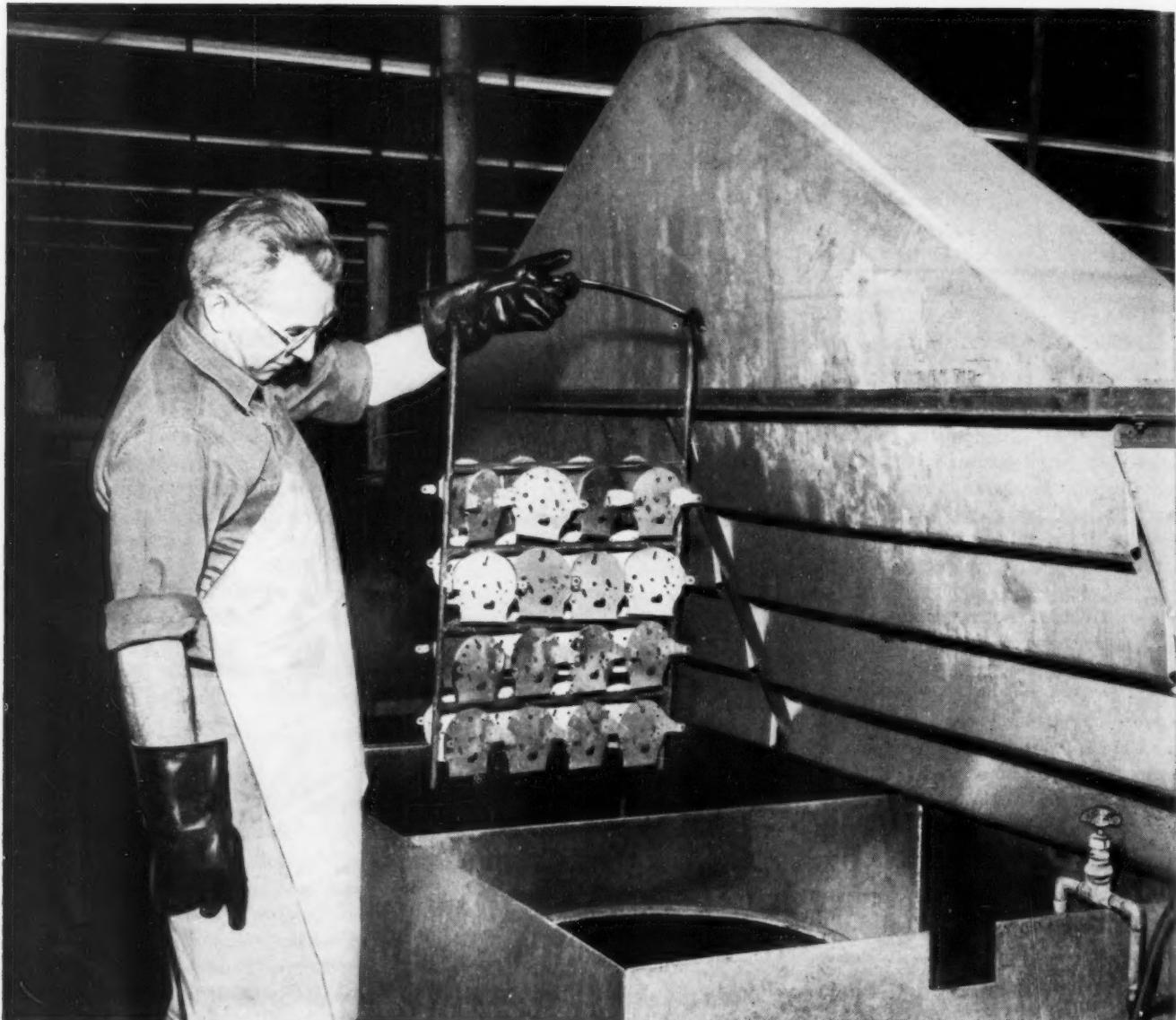
*U. S. Patent 2,683,085. July 6, 1954.
K. Lohberg, assignor to Metallgesellschaft Aktiengesellschaft*

A process for removing cladding from iron which is clad with a metallic cladding selected from the group consisting of copper, nickel, tin, chromium, cadmium, zinc and mixtures of such metals which comprises contacting the clad metal with molten magnesium at a temperature below the melting point of the iron until the cladding is dissolved by the molten magnesium.

Plating Non-Conductors

*U. S. Patent 2,683,112. July 6, 1954.
H. J. Reindl and S. R. Prance, assignors to General Motors Corp.*

In the method of plating a steering wheel made from plastic material including a metal core and the rim portion thereof connected by metal spokes to a hub, comprising the steps of; inserting a plurality of metal pins through said plastic material and into said core wherein the portion of said pins which are exposed at the surface of the plastic are flush therewith, painting the surface of the plastic material with a conductive paint so that the paint completely covers the plastic rim and overlies and connects the exposed ends of said metal pins, con-



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necting the core at a point remote from said metal pins to one side of a current source and then immersing the wheel in a plating bath including an anode which is connected with the other side of the source whereby electrodeposition of the metal plate on the conducting surface of the paint occurs for coextensively covering the plastic and the ends of said metal pins for forming a smooth decorative cover thereover.

**Anodizing and Coloring
Aluminum**

*U. S. Patent 2,683,113. July 6, 1954.
S. R. Prance and H. J. Reindl, assignors to General Motors Corp.*

In a method for making waxed and colored aluminum ice trays, the steps comprising: cleaning the surfaces of an aluminum ice tray; brightening the surfaces of the tray by immersion in a chemical brightening solution; anodizing the brightened surfaces; dyeing the anodized surfaces by immersing the tray in a hot solution of a soluble organic dye and simultaneously sealing the dye within the pores of the anodized surfaces; continuously protecting the surfaces of the tray against oxidation by the maintenance of a protective aqueous coating thereover throughout the time required to perform said steps and to transfer the tray from one step to the next subsequent step; drying the tray; immediately coating the dyed surfaces of the tray by immersing the dyed and sealed tray in a hot, fluid wax-like material for providing a wax-like covering all over the surfaces of said tray; and then removing the tray from the wax-like material and cooling the same; all of said steps being sequentially performed without delay therebetween and all of said steps except the waxing step being separated by rinsing steps.

Barrel Finishing

*U. S. Patent 2,683,343. July 13, 1954.
C. R. Gillette and W. P. Burroughs, assignors to General Motors Corp.*

A tumbling process for treating bearings comprising the steps of removing lubricant from the bearings with a solvent, and tumbling the bearings in a solution containing a detergent, finely divided abrasive in suspension and a stable chelating agent which chemically combines with fer-

rous metal ions present in material adhering to the bearings and which forms with these ions stable compounds that enter into and remain in solution during the entire tumbling operation.

Antimony Bath

*U. S. Patent 2,683,114. July 6, 1954.
J. D. Little, assignor to The Harshaw Chemical Co.*

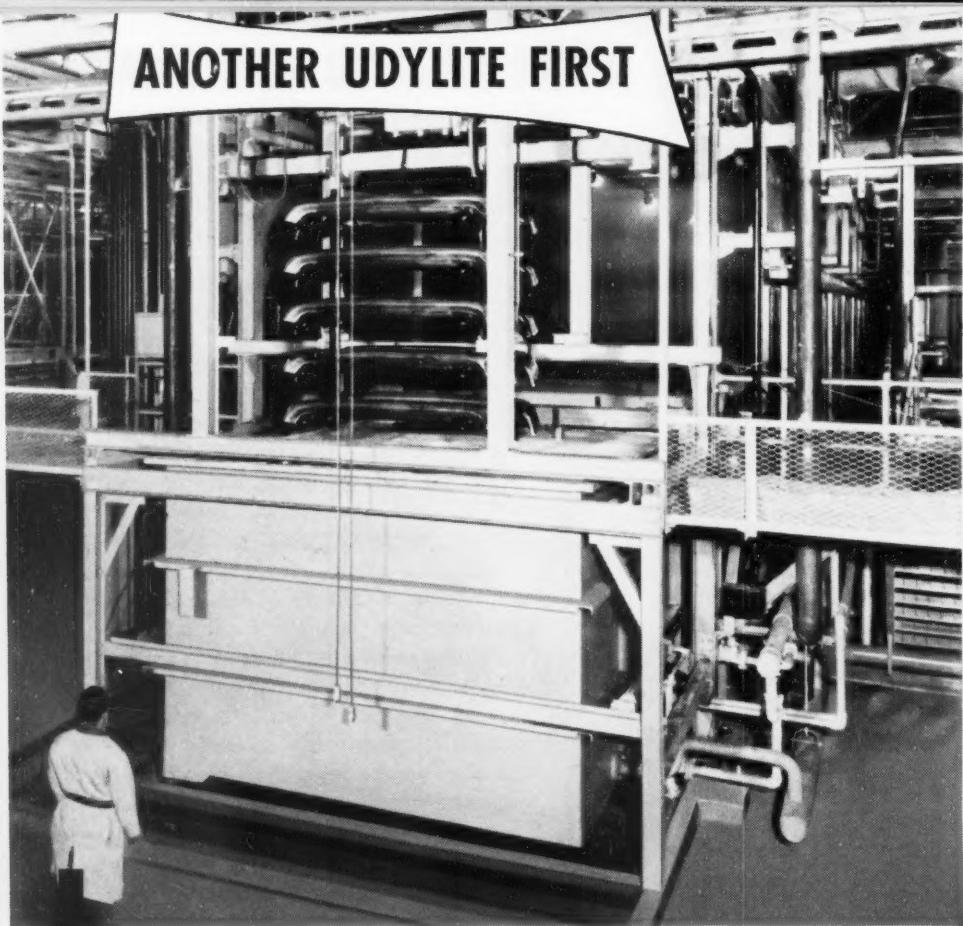
A process for electrodeposition of an adherent, lustrous coating of antimony on surfaces of the class consisting of lead, tin, silver, alloys of a plurality thereof and rough steel, comprising electrolyzing between an anode and a cathode of said class an aqueous, acid solution containing an antimony compound affording a source of antimony ions and means for adjusting the pH of said solution to from 2.5 to 5.0, said solution also containing cooperating adherence promoting and brightening addition agents one thereof being of the class consisting of benzene sulfonamide, di-benzene sulfonamide, bi-di-benzene sulfonamide, di-benzene sulfonamide ether, and toluene sulfonamide and being present in solution in concentration from 0.5 to 6 grams per liter, and the other thereof being of the class consisting of diphenyl guanidine and triphenyl guanidine and being present in concentration from 0.005 to 0.07 gram per liter.

Bright Nickel

*U. S. Patent 2,683,115. July 6, 1954.
A. H. Du Rose and K. S. Willson, assignors to The Harshaw Chemical Co.*

A nickel plating solution essentially consisting of an aqueous acid solution of nickel material supplying nickel ions and an addition agent dissolved in said solution and capable of imparting to deposits produced therein improved smoothness and buffability, said solution essentially consisting of a composition of the class consisting of aqueous solutions of nickel sulfate, aqueous solutions of nickel sulfate and nickel chloride, aqueous solutions of nickel fluoborate, aqueous solutions of nickel fluoborate and nickel sulfate and aqueous solutions of nickel sulfate and said addition agent being selected from the class consisting of coumarin and its substitution products wherein a substituent of the class consisting of alkyl radicals containing not more than four carbon atoms, acyl

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radicals containing not more than 4 carbon atoms, halogen and carboxyl groups replaces a hydrogen atom of the coumarin, such addition agent being dissolved in said solution in concentration from 0.05 gram per liter to saturation, said solution also containing from 0.05 to 1.5 grams per liter of formaldehyde.

Metal Spraying of Tubes

*U. S. Patent 2,683,436. July 13, 1954.
I. H. Marantz, assignor to Columbia
Cable & Electric Corp.*

An installation of the character described for coating metal tubes, comprising a metal spraying unit having a fixed spray nozzle, means to grip and simultaneously and positively to rotate such tubes and advance the latter lengthwise through said metal spraying unit past fixed spray nozzle to be acted upon thereby, whereby the entire outer surface of such tubes may be uniformly coated without any portion thereof being subjected to the action of said spraying unit for any excessive period of time, the means for gripping such tube and simultaneously rotating and advancing the same comprising a housing, means rotatably mounting said housing, a pair of rollers rotatably mounted in said housing lying in the same plane with their axes parallel to each other, said rollers having their peripheries spaced from each other and having gripping means thereon, means to guide a tube into said housing between said rollers to be gripped thereby, drive means to rotate said rollers to advance the tube therebetween, means to guide such tube out of said housing from said rollers and drive means to rotate said housing.

Metal Spray Gun

*U. S. Patent 2,683,623. July 13, 1954.
R. M. Brennan.*

Apparatus for spraying molten metal comprising a container for molten metal, a spraying device through which molten metal from said container is adapted to flow for spraying from said device, and means for maintaining a predetermined uniform level of metal in said container for achieving uniform spraying results including a feeding unit controlled by the level of metal in said container for feeding molten metal thereinto and overflow means on said container maintaining such uniform

level in the event that the rate of feeding of molten metal into said container exceeds the rate of spraying thereof by said device.

Conducting Coating

U. S. Patent 2,683,670. July 13, 1954.
D. Perlman.

A coating composition for producing on the surface of an object of insulating material a continuous metallic electrode surface coating having a thickness of at most about 0.0003 inch which is effective as a surface electrode for electro-forming on such surface electrode a firm metallic structure having the shape of said electrode surface coating, which coating composition consists essentially of liquid absolute alcohol having suspended therein a powder composition consisting essentially of silver powder and about 5% to 7% stearic acid by weight, said silver powder having a particle size which floats in the air when stirred with a brush.

Porcelain Enameling

U. S. Patent 2,683,672. July 13, 1954.
A. E. Chester, assignor to Poor & Co.

In a method of coating ferrous metals with vitreous enamels, the step which comprises pretreating the ferrous metal with a substantially uniform thin coating containing potassium antimonyl tartrate and a chloride of a metal from the group consisting of nickel and cobalt.

Bright Nickel Plating

U. S. Patent 2,684,327. July 20, 1954.
F. Passal, assignor to United Chromium, Inc.

In an aqueous acidic bath solution for bright nickel plating containing at least one nickel salt as the source of the nickel and a substituted aromatic compound as a secondary brightener in which said substituent comprises an $-SO_2$ containing radical with the S atom linked to the aromatic ring of said compound, the combination therewith as a primary brightener of about 0.005 to 0.05 g./l. of an indazole derivative comprising indazole having a radical substituted in the six-membered ring thereof, said radical containing a non-metallic atom which is linked to said six-membered ring, and said non-metallic atom being selected from the group consisting of nitrogen, oxygen, sulfur, carbon, and halogen.

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Since the introduction of Zero-Mist less than a year ago by Udyline, hundreds of users have written acclaiming the benefits of this fine new product.

Here are a few comments . . . "70% reduction in chromic acid use" . . . "29% reduction in cost" . . . "considerable reduction of chrome dragout" . . . "satisfactory in keeping down fumes and spray" . . . "If necessary could turn off exhaust system" . . . "Our chromic acid usage cut more than 50% and our fume problem eliminated" . . . "Zero-Mist reduces film dragout."

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DETREX

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DEPT. EM-106, BOX 501, DETROIT 32, MICH.



Electropolishing Zinc

U. S. Patent 2,683,687. July 13, 1954.
R. M. Wick, assignor to Bethlehem Steel Co.

The process of anodically polishing zinc surfaces which comprises electrolyzing a zinc-coated steel article in an aqueous solution consisting essentially of chromic acid (approximately 250 grams per liter) and boric acid (approximately 12 grams per liter) at a current density of approximately 150 amperes per square foot and at a temperature of from 70°-90°F. for not less than 10 seconds, said zinc-coated steel article acting as the anode.

Treatment of Silver to Inhibit Tarnishing

U. S. Patent 2,684,328. July 20, 1954.
C. F. Matthews and J. C. Sawyer, assignors to Oneida, Ltd.

A process for inhibiting the formation of silver tarnish which comprises contacting a silver tarnish-susceptible article with an aqueous solution consisting essentially of a fluoroborate of a metal more electropositive than silver for a time sufficient to render said article tarnish resistant and insufficient to deposit a visibly detectable layer of said metal on said article, said article having a surface consisting at least in part of a metal of the group consisting of silver and alloys of silver wherein silver is the predominant metal, said solution having a concentration of at least one per cent of said fluoroborate.

Corrosion Inhibitor

U. S. Patent 2,684,332. July 20, 1954.
G. H. Rohrback, D. M. McCloud and W. R. Scott, assignors to California Research Corp.

A pelleted corrosion inhibiting composition characterized by a high crushing strength consisting essentially of a uniform coherent mixture of sodium arsenite and arsenous oxide, the weight ratio of sodium arsenite to arsenous oxide being in the range 1:10 to 10:1.

Corrosion Inhibiting Composition

U. S. Patent 2,684,333. July 20, 1954.
G. H. Rohrback, D. M. McCloud and W. R. Scott, assignors to California Research Corp.

A pelleted corrosion inhibiting composition having a density of at

least 2.5 grams per cubic centimeter consisting predominantly of a uniform coherent mixture of a major proportion of sodium arsenite and a minor proportion of metallic zinc.

Spot Plating Chromium

*U. S. Patent 2,684,939. July 27, 1954.
C. F. Geese, assignor to Time, Inc.*

Plating apparatus for spot electroplating conducting surfaces comprising, a rigid non-conductive tip formed with a hollow portion therein providing a reservoir for plating solution and having a capillary opening at the extremity thereof connecting with the hollow portion for gradually releasing the solution upon movement of the extremity of said tip against a surface to be plated and an elongated anode within said tip having an end adjacent the opening, said extremity of said tip having slots intersecting and extending away from said capillary opening to prevent gases formed by electrolysis from blocking the capillary opening.

Brass Solution

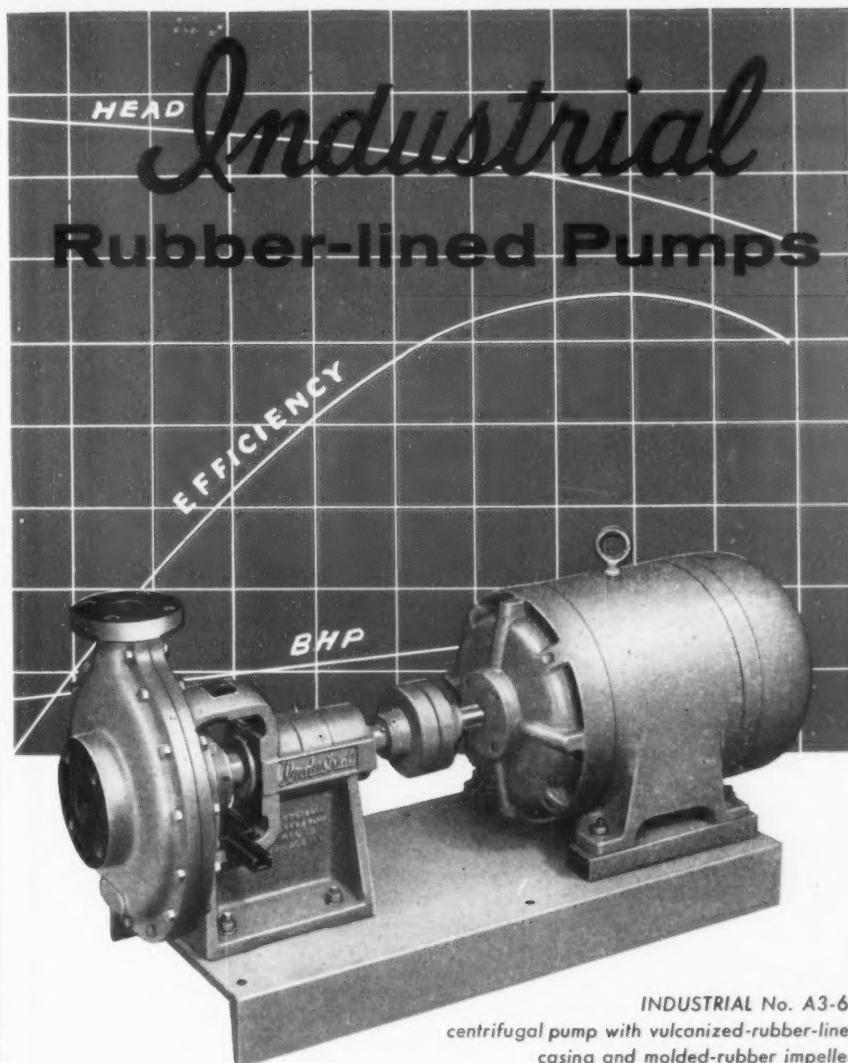
*U. S. Patent 2,684,937. July 27, 1954.
L. R. Westbrook and E. J. Roehl, assignors to Pittsburgh Steel Co.*

A yellow brass plating bath comprising in aqueous solution, sodium cyanide, copper cyanide, sodium hydroxide and a cyanide soluble zinc compound, the sodium hydroxide being present in concentration exceeding 3 ozs. per gallon and the zinc being maintained in low concentration, such that the ratio of copper to zinc in solution lies between 35:1 and 10:1.

Gas Plating

*U. S. Patent 2,685,121. Aug. 3, 1954.
O. F. Davis and H. G. Belitz, assignors to The Commonwealth Engineering Co. of Ohio*

The method of preparing metal foil which comprises, maintaining a cylindrical roll in continuous revolving motion, coating a substantially cleared surface of the roll with an adherence-reducing medium, heating said roll to a temperature in the range of 350° F. to 450° F., impinging a gaseous stream of inert gas and metal carbonyl against said heated revolving coil whereby the carbonyl is decomposed and the metal deposited to produce a film on said roll, and continuously stripping the thin film of deposited metal from said roll.



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These pumps are made in a range of sizes with capacities up to 240 gpm., operating heads up to 240 feet, and $\frac{3}{4}$ to 15 hp. They are furnished either with or without base, motor, and coupling.

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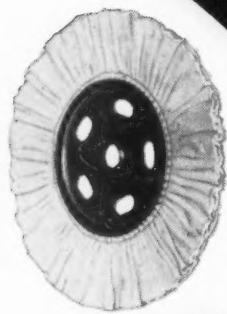
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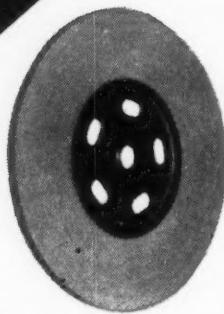
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ABSTRACTS

Test Equipment for Anodized Coatings

Communication from the Ranshofen Research Institute: *Aluminum-Ranshofen Mitt.* No. 1, p. 6 and No. 2, p. 34 (1953).

For the testing it is best to utilize certain electrical characteristics of the coating as a criterion and, in particular, dielectric measurements, determination of the insulation break-down current and the break-through voltage. An apparatus was devised on this basis and, from the details given, any inter-

ested person can build similar equipment from commercially available parts. The apparatus is described with the aid of diagrams and operational details are provided. In the second part, the operational experience and results obtained with the use of this research apparatus are presented from a practical standpoint.

Spectrographic Determination of Nickel and Cobalt Contents in Bright Nickel Baths

M. Scalise: *La Metallurgia Italiana*, Vol. 45, p. 170.

The positive results of tests which were carried out to develop a simple spectrographic method for the determination of the nickel and cobalt contents

of solutions, are presented by the author. The method provides the possibility of a simple analytical control of the chief constituents and of the impurities of bright nickel baths, which can be rapidly carried out and which is accurate.

Stripping of Electroplate and Lacquer

Metallic Bulletin (Netherlands), p. 269 (1953).

A presentation is given of the processes which can be employed for the stripping of non-noble metals from nobler base metals, non-noble metals from similar base metals, nobler metals from non-noble base metals as well as the removal of lacquer coatings.

Studies on Electrodeposited Alloys

K. Aotani: *Electrochem. Soc. (Japan)*, Vol. 20, p. 611.

The X-ray structures of electrodeposited alloys of iron-nickel, nickel-cobalt, cobalt-iron, copper-zinc, silver-cadmium, silver-copper, zinc-cadmium were examined in previous research by the author. Work in continuation is described on the structure of the following alloys: tin-cadmium, tin-zinc and iron-nickel-cobalt.

X-Ray Examination of Electrodeposited Bright Nickel

N. Kasai, M. Kakudo and T. Watase: *Electrochem. Soc. (Japan)*, Vol. 21, p. 215.

In recent years various work on bright nickel deposits has been undertaken and published. Hothersall and co-workers observed a laminar structure approximately parallel to the base metal surface without the crystal structure appearing. The authors investigated the structure and grain size of bright nickel deposits. The test deposits were produced under various conditions and from varying types of baths. The baths contained alpha or beta sodium naphthalene monosulfonate as the brightening agent. The X-ray examination showed neither a change of the lattice constants nor any favored crystal orientation. The orientation and size of the crystallites was calculated according to the Jones method with the use of heat treated control tests. The dimensions were

found parallel to the right angle axis at a and $b = 50 \text{ \AA}$, $c = 1300 \text{ \AA}$. These dimensions are considerably smaller than the normal nickel deposits. From these findings it would appear correct to assume that the cause of the brightness of the deposit is not the crystal orientation but the crystal size. The abnormal X-ray diffraction can be explained not only by the crystal size but also by the lattice distortion and rotation.

Metal Coloring by Electrodeposition of Interference Thin Film; Part I Determination of Coloring Conditions

M. Kikuchi and N. Kaneki: *J. Electrochem. Soc. (Japan)*, Vol. 21, p. 17.

By the electrolysis of a complex solution of copper, tartaric acid and caustic soda with the use of carbon and copper sheet as the anode and cathode, two stages of electrolytic reaction were established by the current-voltage curve. At the first stage, interference films were obtained in the colors orange, red, silver-white, yellow and golden yellow, following each other in sequence three times, until finally a gray film was formed. The description of the test results was amplified by means of curves.

Red Gold Alloy Plating

E. Raub: *Metalloberflaeche*, Vol. 7, No. 2, p. A 22.

The structure of copper-gold alloy deposits is studied by the author as affecting the properties and behavior of the gold plate. When recrystallized from the molten metal, the alloys form a continuous series of mixed crystals. A study of the lattice constants of these mixed crystals was made together with the study of the lattice constants of electrodeposited alloys and the respective lattice constant curves were superimposed. The lattice constants curves of the electrodeposited alloys conform in no way to that obtained from the lattice constants curve of the recrystallized metals. With electrodeposition, the lattice constant of the gold and/or that of the copper can be observed over the whole range of the composition. Any stronger or weaker reduction of the lattice constant of the gold or increase of that of the copper respectively occur only at single points. These values, however, deviate from the

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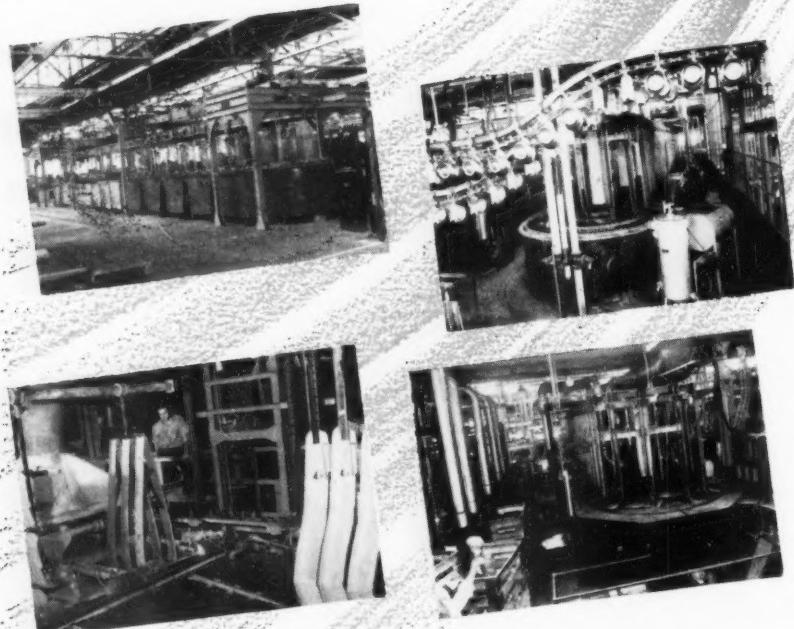
course of the lattice constants of the recrystallized alloys.

The above facts thus serve to show that electroplated copper and gold crystallize during electrolysis independently of one another. Electroplated silver and gold on the other hand crystallize with the formation of a progressive series of mixed crystals. These findings are of considerable practical interest as regards gold alloy plating practice, particularly with respect to red gold, which is a gold-copper alloy. They explain a fact which has become obvious to the technician by repeated observation that the electroplated deposits of gold and copper, often even with high gold contents, show a strong tendency to surface discoloration while, on the other hand, gold-silver alloys

with a sufficient gold content are practically tarnishproof. The cause of this, according to X-ray examination, is the occurrence of copper crystallites which have a low resistance to discoloration. Also with the ternary alloys which contain gold, copper and silver, the insertion of the copper in the mixed crystal is incomplete, as is shown by the lattice constants of the ternary alloys. Thus with the simultaneous deposition of gold, silver and copper, there are often obtained deposits which have little stability to surface discoloration, even with the higher gold contents. It should be noticed that the inclusion of the copper in the mixed crystals with the simultaneous co-deposition of silver is easier than with the binary red gold-copper

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alloys. The same holds true for the white gold-nickel deposits. X-ray examination shows that, throughout, only small amounts of nickel are held in solid solution in the gold by mixed crystal formation. In general, the nickel crystallizes separately from the gold. In practice however, this fact is not so unfavorable as with the red gold-copper deposits. On the one hand the nickel content in the electroplated white gold alloy remains small and on the other hand the nickel is much more stable to atmospheric influences than copper.

An improvement in the color stability of the red gold plate can be obtained by suitable heat treatment after plating. This heat treatment serves to promote the formation of mixed crystals of gold and copper. The red alloy plate which is easily discolored when exposed to the atmosphere is then converted into a practically stable non-discolorable alloy, provided that the copper content is not too high.

Pickling Treatments for Magnesium Metals

M. Straschill; *Beiztechnik*. Vol. 3, No. 1.

Cleaning in alkaline solutions serves not only to remove oily matters from the surface but can also be used to remove coatings formed by a bichromate treatment if these need to be stripped. The most effective agents are strongly alkaline solutions with a pH value over 11 and used at boiling, of the following composition: 30 g. crystalline trisodium phosphate ($\text{Na}_3\text{PO}_4 \cdot \text{H}_2\text{O}$) ; 30 g. crystal soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$) with 1 g. soap in 1 liter of water. A suitable wetting agent can be used in place of or with the soap with advantage. Extremely large parts which cannot be treated in the bath can be rubbed down with Vienna chalk which removes not only the oil and grease but also any adherent dirt. Bright pickling baths serve to remove oxides, hydroxides, old coatings as well as substances which the alkaline baths do not remove. These generally contain dilute acids as the effective cleaning agent. Two types of acid solution are used for the purpose: 1. those which attack the magnesium metal (nitric, sulfuric, acetic and similar acids) and 2. those which do not

attack the magnesium (chromic or hydrofluoric acid). The first solutions produce a metallic bright surface within the shortest time (within a few seconds) associated with a certain removal of the base metal. The most effective bath in this class can be regarded as a dilute nitric acid solution. A concentration of 10% or less is sufficient. The operation is to immerse the objects for a few seconds into the nitric acid, then to remove them rapidly, allow them to drain for a few seconds, then to rinse first in cold water and subsequently to give a rapid immersion in boiling water and to dry off. The surface obtained with most magnesium alloys is silver white. If there is a rainbow coloration on the surface this can be removed by a short treatment in 3% nitric acid. The effect of the nitric acid is to activate the surface and so increases the attack by moisture. This fact must be considered and the water only allowed to come into contact with the metal for the shortest possible time or the attack inhibited by small additions of alkali chromate or dichromates (about 0.2%). A pickle on a sulfuric-nitric acid basis is comprised of: 8 liters conc. nitric acid, 2 liters conc. sulfuric acid and 90 liters water. The bath is operated at room temperature and immersion is for 10 seconds.

A bright pickling treatment is provided by first degreasing in a solution consisting of 22.4 g. crystal sodium carbonate, 14.9 g. sodium hydroxide and 0.8 g. soap per liter at 83 to 100°C. for 10 minutes. After rinsing and dipping in 7 to 10 vol. % nitric acid, a rinse is given in flowing water. The dip then follows in the actual bright pickle bath of the following composition: 180 g. chromic acid, 30 g. sodium nitrate and 0.9 g. magnesium or calcium fluoride per liter. The bath is worked at room temperature, dip time is 15 seconds to 1 minute and agitation of the ware or solution is necessary. For pickling treatment for plating on magnesium careful control is required. In acid solutions, because of the strong gas generation, an incomplete or generally non-adherent metal plate is obtained. In alkaline solutions above a pH value of 10 the surface oxide is not attacked. Only in pyrophosphate solutions is it possible to bring magnesium oxide and hydroxide smoothly into solution.

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In many instances the first cost of a Sparkler filter will exceed that of some other types of plating filters.

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Pre-coating Sparkler horizontal filter plates requires only about one-third the amount of filter aid used by some other filters.

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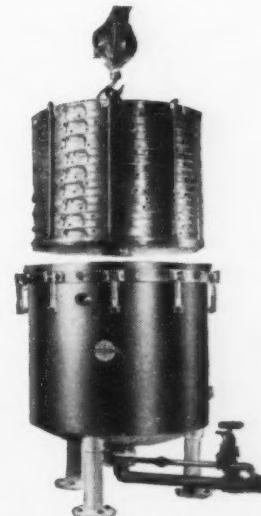
Intermittent operation of the filter will not break up the cake on horizontal plates. No renewal of pre-coating is necessary after a period of inactivity.

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Recent Developments

Conversion Coating

Kosmos Electro-Finishing Research, Inc., Dept. MF, 13 Valley St., Belleville, N.J.

Ker-Chro-Mite GZ, a new development by the above firm, is an olive green conversion coating for zinc. The product, which is chromate type, is supplied in stable concentrated solution which is cut to desired strength for use. The process imparts a uniform olive green on zinc which passes 100 hours of salt spray test to formation of white oxides, it is claimed. The bath once made will not break down easily. It is used at or below room temperature. The working bath needs only periodic replenishment with the concentrate.

The film formed has excellent properties as a base for paint or as an attractive olive green finish. It is adaptable to all Federal Ordnance finishes requiring high corrosion protection as well as uniformity of color.

Paste Soap Dispenser

Gus J. Schaffner Co., Dept. MF, Emsworth, Pittsburgh 2, Pa.

The "Little Doc" Disolvit dispenser is to be used where the user wants an economical and efficient hand cleaner at his finger tips that can be used either with or without water.

The dispenser is claimed to be revolutionary in the fact that it dispenses, with one push of the handle, enough heavy duty, paste type, hand cleaner



for one washing, at the rate of 3 washings for 1c.

To insure the convenience of the dispenser, a big 300 washing, 7½ lb., throw away type cartridge has been used, which can be replaced in 60 seconds. The attractiveness of the dispenser is evident by the symmetrical design and complimentary color scheme. The dispenser will offer many long years of rough use because it is constructed of 18 gauge steel.

Filter Units

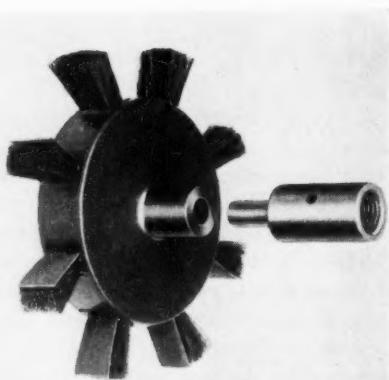
Comco, Inc., Division, Enthone, Inc., Dept. MF, 442 Elm St., New Haven, Conn.

A new series of cartridge type filter units, designed especially for the electroplating and electroforming industries, are available in a variety of models ranging from 100 gallons to 5,000 gallons or more per hour. They are available in iron, stainless steel, rubber and plastic for use with all types of corrosive solutions. The units are easy to assemble and disassemble. Cartridges woven with a variety of fabrics to withstand solutions can be used, including cotton, dynel, orlon, glass, acetate and nylon. An illustrated brochure is available describing these units.

Adaptors for Abrasive Wheels

Merit Products, Inc., Dept. MF, 4023 Irving Place, Culver City, Calif.

With the addition of two new sizes, the company now has available a complete line of adaptors for use with their Sand-O-Flex brush-backed deburring wheels. The adaptors make it possible to use the abrasive wheels on any shaft up to 1¼" dia. The wheels are bored ½" for the small, home-workshop model; ½" and 5/8" for the intermediate sizes; ¾" for the large industrial unit. Normally, the sanding heads will fit any machine shop spindle (motor shaft, lathe, grinder, drill press, etc.) but in cases where spindles are undersize, oversize or threaded, adaptors are necessary. The adaptors



are available either for plain or threaded spindles ranging in sizes from ¼" drill chucks to 1¼"-7 male thread. No other mount is needed.

Made from alloy bar stock, adaptors will last the life of the wheel. Ends which insert into the bore of the wheel are milled flat; those for plain spindles are supplied with set screws. A bleed hole is drilled in threaded adaptors.

Barrel Finishing Compound

Minnesota Mining and Mfg. Co., Dept. MF, 900 Fauquier St., St. Paul 6, Minn.

A new barrel finishing compound designed to produce especially smooth finishes on light metal die castings is called Honite brand Micro Cut. The compound is recommended for use on die castings of zinc, aluminum and other light metal alloys. It will remove light machine marks and leave an extremely fine surface finish, with a minimum of stock removal, avoiding deep scratches and exposure of porosity in castings.

The smoothness of the surface produced by the compound, containing a very fine mineral grain which gives it a mild abrasive action, improves the quality of subsequent plating and ball burnishing operations, according to the manufacturer.

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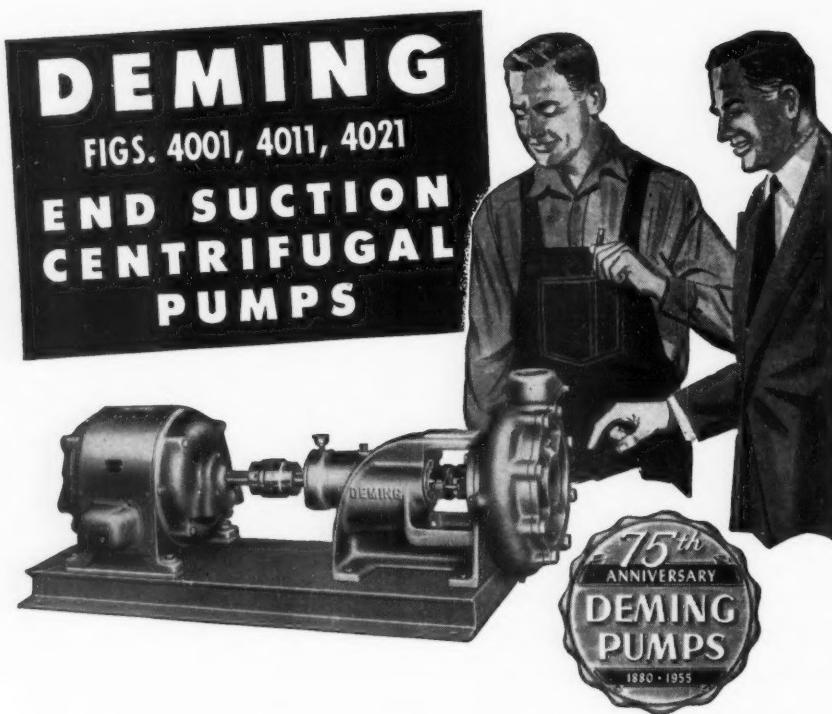
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Worklon, Inc., Dept. MF, 253 West 28th St., New York, N. Y.

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The newly designed Dynel weave, a company exclusive, is exceptionally resistant to acids and caustics; and has been proved to outlast wool and cotton by as much as 22 to 1 under specific chemical conditions, according to claims. In addition, work clothes of this new fabric present a far neater, handsomer appearance. The pleasing grey color actually serves to "camouflage" dirt—requires less laundering.

Portable Mixed-Bed Demineralizer

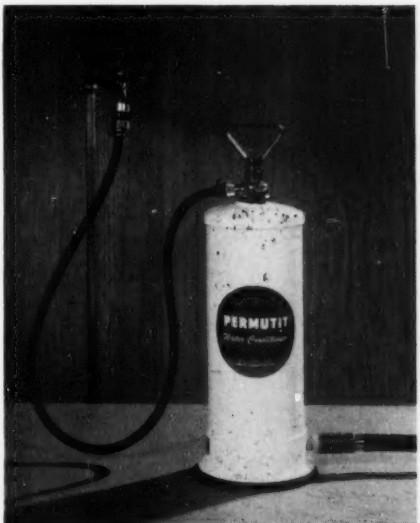
The Permutit Co., Dept. MF, 330 West 42nd St., New York 36, N. Y.

For the production of small quantities of pure water, a compact, portable unit, the Model MBD-6A demineralizer contains a bed consisting of an intimate mixture of Permutit Q, a cation exchanger and Permutit S, a highly-basic anion exchanger, and it is used to produce a water of low total dissolved solids, low CO₂, low silica content and low conductivity.

In service, the inlet hose is connected to a raw water supply and the outlet connected either into a pipe line or left free to be put into any container where water is required. The faucet, to which the raw water inlet adapter is fastened, should be used to regulate the flow through the unit. Flow rate is 1 to 2 gpm. maximum.

A conductivity meter (not shown) is used to indicate the dissolved solids content of the effluent water and will thus show when regeneration of the exchange resins or a new refill is required. The unit has a capacity of approximately 1,500 grains total dissolved solids. During each cycle or run, it is capable of demineralizing 250 gallons of raw water containing 100 ppm total electrolytes; or 125 gallons of raw water containing 200 ppm total electrolytes. When the unit is exhausted, the resins may be removed, discarded and replaced with a new refill. However, the resins can be regenerated, and re-used.

The conductivity meter is provided with a 4 ft. length of electric wire for attaching the meter to a conductivity cell, and a 6 ft. length of wire leading to a convenient outlet for current supply. A standard 110 volt, 60 cycle



Cut anode costs more than 1/2!

For a given length of anode rod you may, for example, buy three 22-inch, 3-rib conventional extruded lead anodes.

*Price would probably be about \$5.60 each. Total: \$16.80.

These anodes would last you about 9 months in normal service.

Cost per month: \$1.87.

For the same length of anode rod you would need two 22-inch Conducta-Core anodes at about \$17.50 each. *Total: \$35.00.

BUT the Conducta-Core anodes will last you 3½ years!

Cost per month: \$.83!

The answer is the unique design. The challenge is to see for yourself. Try Conducta-Core now.

**These prices are approximate. They vary with market conditions but since both are dependent upon the price of the base metals of which they are made, the relation between them remains much the same.*

Photo courtesy U. S. Metals Coatings Co., Inc., Elizabeth, N. J.

Federated Metals Division

**AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY, NEW YORK 5, N. Y.**

In Canada: Federated Metals Canada, Ltd., Toronto and Montreal

**Aluminum, Magnesium, Babbitts, Brass, Bronze, Anodes, Zinc Dust,
Die Casting Metals, Lead and Lead Products, Solders, Type Metals**





MODEL OP2

NOTE THESE FEATURES . . .

1. **Unobstructed tank walls.** Condensing coil and condensate pan are recessed providing superior vapor control, effective solvent reclamation and unobstructed working area.
2. **Demand type water control.** Insures using water only when needed, thereby reducing operating cost. Placement of nickel plated condense coils in conjunction with new type water control eliminates water condensation along the sidewalls of degreaser, thus, preventing rusting of the sidewalls and acid solvent, increasing the life of the degreaser.

SINCE 1923



EQUIPMENT COMPANY

130 Central Avenue, Clark (Rahway), New Jersey Offices in principal cities
PER-SOLV (Perchlorethylene)
CIRCO-SOLV (Trichlorethylene)

Vapor and Ultrasonic Degreasers • Metal Parts Washers • Dryers • Solvent Recovery Stills

current supply is required. In normal service, the meter may remain connected to the power supply and cell, and operated solely by means of a switch on the case.

It is recommended that one or more spare refills be purchased with the unit.

Tank Rod Agitator

Metal Finishing Mfg. Corp., Dept. MF, 89 N. 11th St., Brooklyn 11, N. Y.

The new Placo Tank Rod Agitator, designed for economical and dependable performance, has been introduced by the above manufacturer.

The unit is fully insulated with bakelite arm and insulated rollers. It has

CIRCO DEGREASERS

- **Will last twice as long!**
- **Reduce solvent costs 30% or more!**
- **Cut labor costs!**
- **Up to 40% less maintenance!**

3. **New pump design.** All pump parts are fabricated of stainless steel. The rotor and end plates are nickel clad. Rotating magnetic field drives impeller, thus, the pump is completely sealed except the intake and outlet, preventing leakage.
4. **Lower height.** Working height reduced for easy operation.
5. **Built-in storage tank.** Holds adequate reserve for flushing in addition to entire contents of degreaser sump.
6. **Less floor space.** Designed to operate from either side.

OVER 208 STANDARD MODELS... including Circosonic ultrasonic degreasers. All backed by nation-wide technical service.

YOUR INQUIRY BRINGS comprehensive 32-page vapor degreasing manual.

Offices in principal cities
CIRCO-SOLV (Trichlorethylene)

Vapor and Ultrasonic Degreasers • Metal Parts Washers • Dryers • Solvent Recovery Stills

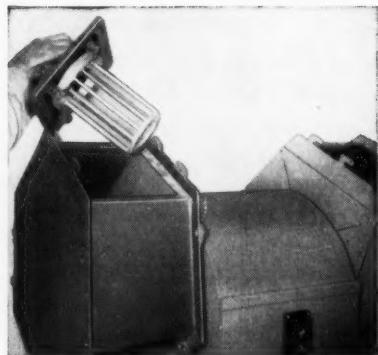
ball bearing stainless steel shaft rollers, ball bearing gear box, V belt drive to change speed, and an adjustable stroke up to 6". It is easily mounted, clamps on to tank and has telescoping extended support. Has 110 volt AC plug in line and switch.

Removable Covers for Rack Tumbling

Rampe Mfg. Co., Dept. MF, 3320 St. Clair Ave., Cleveland 14, O.

For parts that require selective tumbling the manufacturer has perfected a new drum with three removable covers for use on their Super-Twin barrel finisher.

This is an entirely new idea which reduces the cost of rack tumbling as



well as speeding up the operation. Instead of using a specially built barrel with built-in rack, the customer can buy a standard barrel with three openings and standard plain covers to which he adapts his own racking fixtures. By using extra covers a wide variety of parts can be tumbled in the same barrel. And, by having extra covers ready for a quick change, there is practically no lost time, according to the company. The drum measures 10¾" x 23" in diameter. Drums will be sold separate from the unit if desired.

Mold Cleaning Machine

Electrocleaning, Inc., Dept. MF, 2441 E. 83rd St., Cleveland 4, Ohio.

A new automatic electrolytic cleaning process is claimed to remove no metal from the glass mold while cleaning it.

In this cathodic cleaning operation, molds are placed in insulated steel boxes that are fitted with special platinum anodes. A high degree of current distribution, which effects a thorough gaseous scrubbing of the mold's surface, is produced by the anode fixture and accomplished via a special hook-up with a rectifier.

Equipment for the process includes a full-automatic elevator-type conveyor, six treatment tanks, and selenium rectifiers.

Residues on the glass molds are grease, graphite, sulphur, sulphides, and oxides. Dirty molds are placed in their individual anode fixtures, which are then placed on the carrier arms of the automatic conveyor. Molds are (1) degreased, (2) solids released, (3) a sonic rinse follows, (4) oxides are released, (5) another sonic rinse, (6) a final finish before being unloaded.

The company is currently accepting sample molds for treatment at its Cleveland laboratory and is also prepared to demonstrate its process in glass manufacturing plants. The pro-

cess was developed and installed by the Hanson Van Winkle Munning Co., Matawan, N. J.

Hard Chromium

Perfection Industries, Inc., Dept. MF, 8824 Alpine, Detroit 4, Mich.

A new development in the application of industrial hard chrome, as a result of five years of continuous research, has resulted in a product which the above firm calls Superchrome.

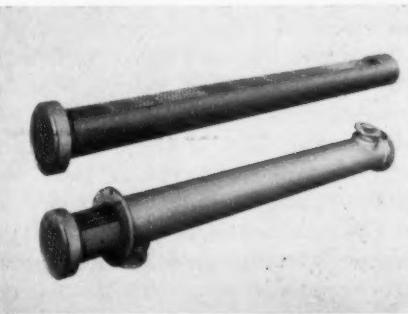
One weakness of ordinary hard chrome is its brittleness. The new chromium coating is claimed to resist chipping and peeling while preserving its extreme hardness. Laboratory tests have proven that eight thousandths thickness of deposit can actually be bent double without breaking the bond between chrome and steel, according to the company.

Graphite Heat Exchanger

Falls Industries, Inc., Dept. MF, 31781 Aurora Road, Solon, O.

An entirely new concept in impervious graphite bundle design is designated the Impervite Cross-Bore exchanger. Simplified construction utilizes a solid bar of graphite measuring the total bundle diameter. This bar is accurately drilled longitudinally and laterally. This new design gives exceptional strength to the bundle and permits use of chemically impervious graphite heat exchangers, even where severe mechanical shock is encountered, such as steam-hammer. The new exchanger will withstand operating pressure in the 150-200 p.s.i. range and is especially recommended for applications where excessive fouling on the shell side is encountered, because all passages are easily accessible by merely sliding the bundle out of the shell.

This bundle is made from selected graphite which is extruded, machined then impregnated with special resins. It is immune to the attack of all cor-



TECH-TIN

Pure Tin Plate in 5 to 60 seconds by immersion only

Tech-Tin deposits a pure tin coating on brass and copper surfaces by immersion at room temperature — no electrical current, no expensive equipment required. Low-cost Tech-Tin quickly provides a good soldering surface and mild protection against corrosion. Recommended for parts identification, decorative effects, inside coating pipes and tubes, etc. Excellent for economical bulk finishing.

Send \$2.00 or purchase order for sample and instructions.

TECHNIC INC.

Jackson 1-4200



PROVIDENCE 1
RHODE ISLAND
U.S.A.

TECHNIC INC., 39 Snow Street, Providence, R. I.

Send us prepaid sample pound of Tech-Tin with instructions for rapid immersion plating. Check (or purchase order) for \$2.00 is enclosed.

Company _____

Address _____

Send Attention of _____

THE LARGEST ENTERPRISE OF ITS KIND IN THE WORLD

rosives except a very few highly oxidizing agents, it has a very high rate of thermal conductivity, is unaffected by thermal shock and will withstand temperatures up to 340°F. (Higher operating temperatures can be accommodated by using Graph-I-Tite which is carbon-impregnated impervious graphite, special alloys, copper, aluminum or can be rubber or lead lined.)

Shells are supplied in impervious graphite, special alloys, copper, aluminum or can be rubber or lead lined.

Periodic Reverse Unit

Metal Finishing Mfg. Corp., Dept. MF, 89 N. 11th St., Brooklyn 11, N. Y.

The new Placo periodic reverse unit, recently introduced, is designed to give a quick, bright, smooth surface, less

porosity and better metal distribution.

Constructed for heavy-duty performance, the unit assures long life and millions of circuit making and breaking operations, according to the manufacturer. It features immediate current build-up, which always starts in plating cycle, dependable rapid switching, and simple plug-in connection for installation to 110 volts, 50/60 cycle line. A pilot light shows the flow of current.

The unit's uniform cycling is self-contained with starting switches and overload controls. An electronic switch permits use of tank for direct current flow for normal plating. Fluctuations due to external conditions are cut to a minimum, and the cycle is adjustable to emphasize any of the features of periodic reverse plating.

CHECK the advantages



**YOU'LL
be impressed too
with these proved performance
features.**

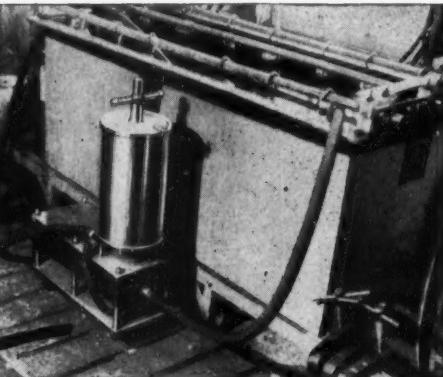
Models for any size or type installation in Stainless Steel, Monel Metal, Plain Iron, etc.

Small, compact — requires exceptionally small floor space coupled with remarkable filtering speed and volume.

Completely enclosed and air tight — eliminates loss of liquid from dripping.

"Sealed-Disc" Filters are complete as shown — slurry mixing tanks are not needed — filtering powders are not generally required.

Simplicity of design assures savings in operating time and labor with positive trouble-free performance.



Every plater who uses a "Sealed-Disc" Filter is impressed with its positive, trouble-free performance.

Regardless of the size or type of your plating installation, there's a "Sealed-Disc" Filter "to fit your job" — you can depend on these proved performance features — you can be sure that all dirt, sludge, and even the invisible impurities are removed from your plating solutions.

"Sealed-Disc" Filters were designed especially to meet plating room requirements. They are smaller, more compact and portable than ordinary Filters, yet they are capable of handling equal volumes of solutions. Ask your regular plating supplier to tell you about the "Sealed-Disc" Filter that has helped so many platers get better finished plated work with savings in time and labor — or write for details.

Other Alsop plating room equipment

We manufacture a full line of Mixers and Agitators covering a complete range of sizes, for mixing, blending and dissolving. Stainless Steel Mixing Tanks are also available in a wide range of capacities. For full details and illustrations write for your free catalogue.

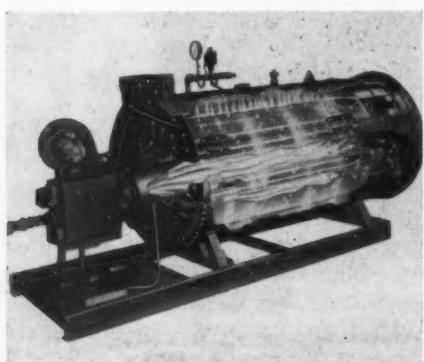
ALSOP
ENGINEERING CORPORATION

1002 Bright Street Milldale, Conn.

15 H.P. Scotch Steamboiler

Eclipse Fuel Engineering Co., Dept. MF, 1002 Buchanan St., Rockford, Ill.

Addition of the new 15 H.P. series to the above manufacturer's line of automatic steam boiler plants, rang-



ing from 12 to 125 H.P., was recently announced. The new model is available for burning gas only, oil only, or gas and light oil.

Over-all dimensions are: length, 160", width, 44", height, 61". Design and construction equals or exceeds all latest requirements of the ASME Code and "Code of Ethics" of the Industrial Gas Equipment Division of GAMA.

Completely assembled, the new boiler is ready for immediate operation after electricity, steam, water, fuel, and stack are connected. All necessary wiring is complete. Equipment includes burners, blower, combustion safeguards, and all necessary valves and controls.

Abrasive Belt Lubricant

D. A. Stuart Oil Co., Ltd., Dept. MF, 2727 So. Troy St., Chicago 23, Ill.



Two new polishing oils for use in grinding and finishing ferrous and non-ferrous metals are called "Excelen FD" for ferrous metals and "Excelen NF" for nonferrous metals. The oils are applied to abrasive belts to reduce loading, give them longer life, and aid in faster grinding and improved finishes. They are available in 12-ounce pressurized cans, and are sprayed on a belt simply by pressing the button on the top of the can.

In field tests, the lubricants contributed to production increases of more than 100% in some instances, and in others belt life was more than doubled, the company said.

The products were tested on stainless steel, hot rolled steel and cold rolled steel, as well as aluminum, bronze, brass and other metals.

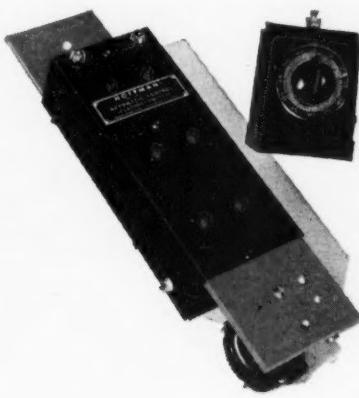
Automatic Cut-Off Switch

Hoffman Plating Co., Dept. MF, 6804 Park Ave., Cleveland, O.

The new Hoffman automatic cut-off plating switch automatically terminates current flow in barrel plating systems after sufficient deposits have been made on the parts being plated. There are two units that make up the control. One is the control box that may be mounted near the tank, usually on a wall. Having its own electrodes, it is easily installed in any barrel plating system by removing the cathode bar and replacing it with the control box. The other unit is the automatic time switch that may be mounted as part of the control box, on the tank or anywhere near the tank that is convenient to the operator.

On each control box, there are two signal lights, one green, the other red. To start the plating cycle, the opera-

tor merely pre-sets the plating time on the timer switch. The green light goes on as the plating cycle begins. When the cycle is completed, the red



light goes on that signals the end of the plating cycle and the cut-off of the current. Thus, plating time is made accurate because error, guessing, forgetfulness and confusion have been eliminated.

A test, covering a year of 255 working days, using cadmium, with current at 650 amps. and deposit rate at .72 oz. per minute, is stated to have proved a savings of 102 hours in plating time and a saving of 275 lbs. of cadmium. With cadmium at \$1.75 per lb., the material savings alone amounted to \$481.25. Production, in this test, went up at least 20%.

Because the operator can turn the current on or off on the tank he is working, he can safely remove the barrel without danger of arc-started hydrogen gas explosions. The switch is designed for long life and trouble-free performance. It is available for immediate delivery in standard models having a capacity of 600 amps. and voltages from 5 to 15 volts.

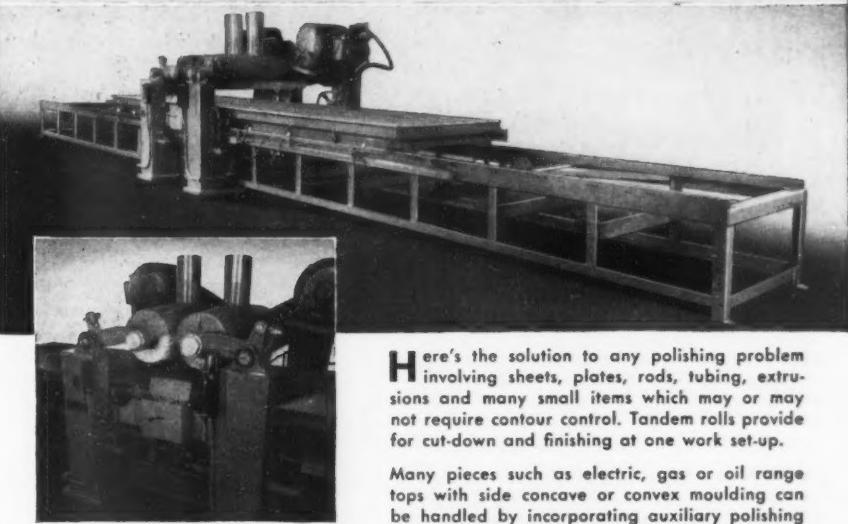
Neoprene Sheet Lining

Caroline Co., Dept. MF, 331 Thornton Ave., St. Louis 19, Mo.

Neoprene No. 750 Sheet Lining is a prevulcanized sheet lining claimed to show maximum abrasion resistance, protection against acid and alkali corrosion and economical application. Applied in the shop or in the field the linings are supplied in rolls 32 to 34 inches wide in varying lengths. Thicknesses are $\frac{1}{16}$ ", $\frac{1}{8}$ " and $\frac{3}{16}$ " depending on the service requirements.

The all-important bonding of the sheet to metal surface or to Neoprene is accomplished by the use of the

Cut Time! Cut Finishing Costs! with CENTRAL Tandem Roll POLISHING MACHINES



FEATURES

1. Central Push Button Control
2. Hydraulic Contour Control
3. Tandem Rolls for faster cutting and finishing
4. Two operations at one work set-up
5. Stepless adjustable stroke, 2" to full capacity
6. Machines made to any length
7. Table can be oscillated sidewise at the will of the operator.

Also made in Single Roll Horizontal Series and Double Roll Vertical Series

CENTRAL MACHINE WORKS
74 Commercial St. Tel. 6-1500 Worcester 8, Mass.

company's Neoprene Adhesive F-1, a one package material, which does not require the addition of catalysts or solvents prior to application. Although the adhesive is a non-vulcanizing type a type of cure does occur on aging even at room temperature. The strength of the bond continues to improve with age.

The sheet lining is used in the transportation, storage and handling of acids, plating solutions, alkalies and various inorganic salt solutions at temperatures up to 190°F. When used to repair damaged rubber or Neoprene linings, or rubber conveyor belts the unit can be placed into service one hour after repairs. A separate data sheet is available describing this application.

Safety Goggles

Welsh Mfg. Co., Dept. MF, 20 Magnolia St., Providence, R. I.

These new rubber mounted, multi purpose goggles are designed with one piece replaceable heavy 040 lens of impact resistant acetate. Special lens composition and 060 pre-formed



Nice Product, Nice Package

Folks often wonder why we spend an extra $\frac{1}{4}$ ¢ a pound out of our own pockets for a lithographed drum. Fact is we're proud of the quality of BFC Chromic Acid and figure it deserves a bright, colorful container.

Every batch gets checked against a tough quality spec. Off-grade acid goes on the dump. Only top-quality material goes into those shiny BFC drums. Send us a modest order and see for yourself.



BETTER FINISHES & COATINGS, INC.

268 Doremus Ave., Newark 5, N. J.
122 East 7th St., Los Angeles 14, Calif.



Lenses are available on request. The goggle has replaceable fabric filters; or wire screen filters on specification. It incorporates wide angle vision with comfort, as straps terminals are out of line of sight and flexibility of strap suspension delivers a better fit. The goggle protects against chemical splashes, spray, dust concentrations and foreign particles.

Emulsion Cleaner-Degreaser

Kelite Products, Inc., Dept. MF, 1250 North Main St., Los Angeles 12, Cal.

Kelite MD-1 is a dust-free powder composition, freely soluble in water and exhibiting high surface activity

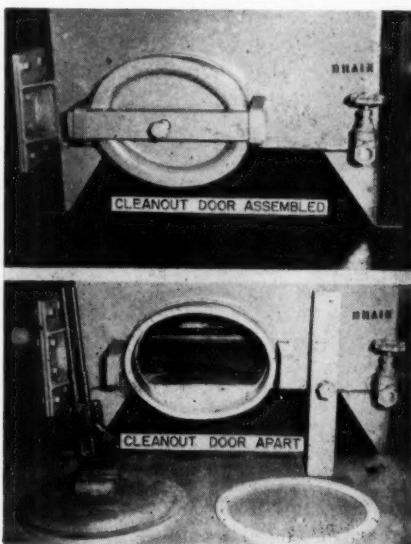
and great cleaning efficiency in the removal of protective mill oil from steel, according to the manufacturer.

It is used as a tank immersion cleaner at 160°F. to 180°F. The cycle employed is 0.5 to 3.0 minutes depending upon the amount and tenacity of the soil present. The material is especially effective when using the Keykote process to deposit a molybdate coating prior to painting.

The cleaner is strongly buffered and, accordingly, exhibits a fairly constant pH over a wide range of concentration. The product has exceptional ability to suspend soil and in the recommended concentration exhibits good cleaning ability for intervals of one month or more.

Vapor Degreaser

Ramco Equipment Corp., Dept. MF, 1373 Lafayette Ave., New York 59, N. Y.



A one-bolt action door, which can be opened in as little as five seconds, is featured as a time and labor saving improvement on Ramco vapor degreasers.

This development is claimed to cut down considerably the time it takes to disconnect steam lines, loosen and remove frozen bolts. A further advantage of the one-bolt action door is that it may be removed repeatedly without gasket replacement.

Additionally, the one-bolt action door design affords complete drainage, while trapping all sludge in an easy-to-clean pocket.

Seal-Less Pumps

Chempump Corp., Dept. MF, Station C, 1300 East Mermaid Lane, Philadelphia 18, Pa.

Designated the Model CHS series, the new 5 and 7½ horsepower pumps are claimed to offer users leakproof pumping at heads to 195 feet and capacities to 300 gallons per minute.

As with other Chempump designs, pumped fluid is allowed to enter the enclosed rotor chamber, providing automatic lubrication of the bearings. Rotor and impeller are an integral unit and the only moving part. The pumps are guaranteed not to leak.

The Model CHS series is available in cast iron, stainless steel, Monel or Carpenter-20 construction as standard. Temperature and pressure limits are 450°F. and 150 p.s.i. with standard models. Much higher limits are possible with special models.

Liquid Neoprene Coating

Emjay Maintenance Engineers, Dept. MF, 327 Union Ave., Rutherford, N. J.

A new 'self-curing' liquid Neoprene coating with outstanding resistance to corrosion has been announced, for use in the chemical, plating and other process industries as well as in metal fabricating plants.

Palladium® Liquid Neoprene is recommended for the protection of new or old equipment and structures, whether made of metal, wood or concrete, against splash, fume or spillage of non-oxidizing inorganic acids, alkalies, inorganic salts and most polar solvents.

It is also effective where chipping and abrasion due to rough handling make the use of ordinary paints impractical. The rubbery texture and high thickness per coat provide extended service life and make the coating ideal for applications where frequent repainting has previously been a costly maintenance problem. Coatings are available in black or gray and may be applied by brush as well as spray.

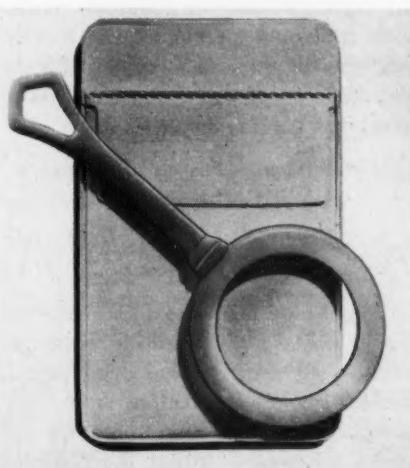
Surface Tension Tester

Pollack Products Co., Dept. MF, 1628 E. 7th St., Brooklyn 30, N. Y.

A new, low cost, pocket size surface tension tester, which has been developed and patent-applied-for, provides a handy and quick way to take accurate measurements under production conditions.

A Jiffy Loop in the pocket of every operator provides a quick constant means of checking and maintaining the solution in proper balance at all times.

The test is made by immersing the clean loop end into the solution. Swish

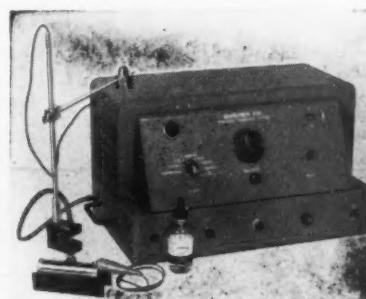


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lead • tin • decorative
and hard chromium



Outstanding features . . .

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around a few seconds, then slowly withdraw vertically. The condition of the film indicates the surface tension and determines the amount of wetting agent in solution.

The loop is available in several standard sizes to cover the complete range of surface tension measurements. Made of easy to keep clean polyethylene for a life time of useful service. It is effective up to temperatures of 200 degrees F.

Multi-Crystal Ultrasonic Generator

General Electric Co., Dept. MF, Schenectady 5, N. Y.

A new high-powered multi-crystal ultrasonic generator which will make possible the construction of larger and more flexible industrial cleaning equip-

ment has been announced by the Specialty Control Department of the company.

The new generator is larger and more powerful, consisting of two separate units. According to company engineers, this makes it possible to design ultrasonic cleaning tanks which can take larger parts, or which can be used for mass-production, continuous-process cleaning of small parts.

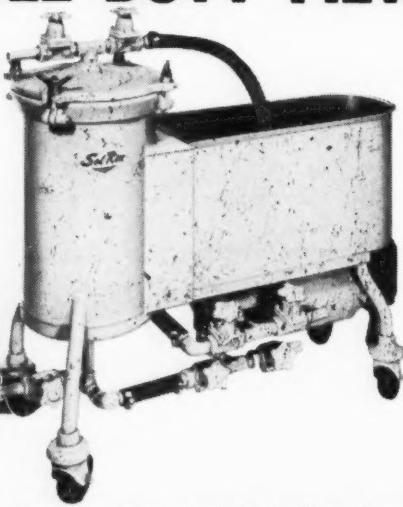
The two units of the new multi-crystal ultrasonic generator are the power oscillator, which is enclosed in a separate cabinet, and the transducer assembly which contains five quartz vibrating crystals and can be remotely located from the oscillator.

The transducers are hermetically sealed so they can be placed directly into a tank of solvent. This, with the

Entirely New Filter Design!



DOUBLE DUTY FILTER



DOUBLE VOLUME New Sel-Rex Annular Type principle doubles filtration area and volume without increasing size of unit.

DUAL PURPOSE Efficient low-cost operation with either cloth bag or porous stone.

EASY OPERATION and MAINTENANCE

- Entire filter element secured to tank cover . . . simple inspection and cleaning.
- Extra capacity precoat tank.
- Colored operating valves located at front of unit permits operation by unskilled help.
- Horizontal hose connections eliminates danger of leaks and ruptures.
- T-valve permits clean changeover from precoat to filtering.

Sel-Rex Filters available in standard sizes (Portable or Stationary models) 175 sq. ft. area. Larger units designed to specifications.

BART - MESSING CORPORATION

Dept. MF-2, 229 Main Street

Belleville 9, N. J.

flexibility achieved with remote location, allows the new generator to be easily incorporated into a regular vapor-degreasing or hot-dip process.

The equipment is also designed so that four transducers may be used with a single power oscillator unit, bringing vastly increased power to a single cleaning installation.

Acid-Proof Concrete Coating

The Ceilcote Co., Dept. MF, 4844 Ridge Road Cleveland, O.

An improved Ceilcrete "B" surface treating material has been extensively tested and is now recommended for low-cost protection of concrete from fluorides, hydrofluoric acid and hydrofluoric acid solutions.

A thermosetting plastic base surfacing, the material can be applied to floors, trenches, tank bases and other concrete structures. A minimum coating of $\frac{1}{8}$ -inch provides a monolithic

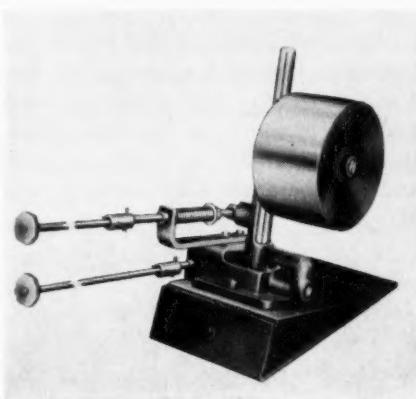


membrane claimed to be impervious to solutions containing hydrofluoric acid. The extreme density and stone-like hardness of the coating make it ideal for a wide variety of applications where resistance to abrasion, impact and constant immersion in acid solutions are important.

The above manufacturer further states that the material is not confined exclusively to applications where hydrofluoric acid is used. Rather, it can be used in a wide variety of installations because only a few chemicals have any marked corrosive effect on this improved material.

Backstand Idler

Hammond Machinery Builders, Inc., Dept. MF, 1600 Douglas Ave., Kalamazoo, Mich.



A new bench model abrasive belt backstand, Model 524, is the newest addition to the company line, and will quickly convert present grinders or polishers into modern, fast cutting, time saving abrasive belt machines.

The device is designed for production work on light polishing or deburring operations. Belts up to 4" wide can be used. Mounting bracket for floor or wall mounting is available to facilitate easy installation. Extension controls for tracking and tensioning can be furnished so adjustments can be made at the operator's working position.

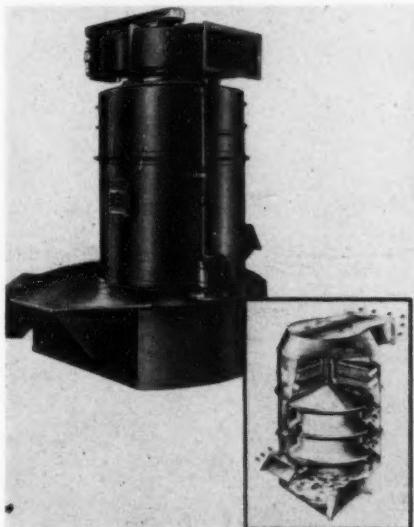
Wet-Type Dust and Fume Collectors

Van-Truer Co., Inc., Dept. MF, 12600 Beech Road, Detroit 23, Mich.

A wet-type dust and fume collector, based on a new operating principle, consists of a cylindrical drum with a series of cones and baffles. Water, supplied by a direct driven pump, cascades downward within the collector.

This action produces a series of closely related water curtains through which the dust-laden air is filtered in its upward travel. A double row of moisture eliminators, fabricated in convenient handling size, are mounted above the washing chamber. Access doors are provided in the housing for inspection of eliminators and wash chamber.

In the operation of this dust collector, the dust and fume laden air are in continuous fluid contact during the upward flow. It is claimed that the baffle design sets up a cyclonic washing action and turbulence, separating the wet dust and carrying it to the sludge tank below. Saturated air



continues up through two-stage moisture eliminator and emerges completely dry.

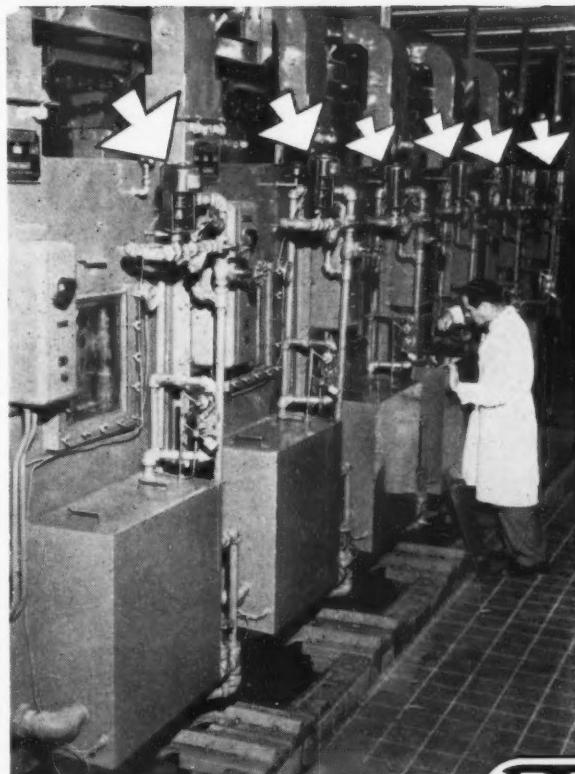
The design of the Van-Truer dust and fume collector incorporates a flat bottom which serves as a settling tank from which the water is recirculated. A chute type of clean-out is provided for easy hand clean-out.

It is stated that this dust collector is also made with a flight conveyor for the purpose of ejecting sludge into a container. The dust collector models are engineered for truss-suspension, floor-setting, or erection on roofs.

Conveyorized Belt Polisher

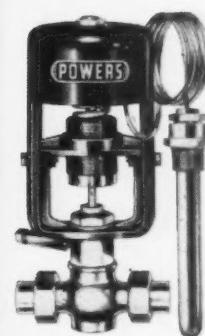
*Curtis Machine Corp., Dept. MF,
Jamestown, N. Y.*

The manufacturer has announced the production of a small conveyorized all purpose grinding, polishing, and deburring machine. The bench type, abrasive belt machine, Model 304C, can handle all types of material and provides high production possibilities at low equipment cost.



AT WYANDOTTE CHEMICAL CO's.

**Modern research
laboratories
METALWASH Spray
Washer is controlled
by POWERS No. 11
Temperature
Regulators**



SIMPLICITY of POWERS

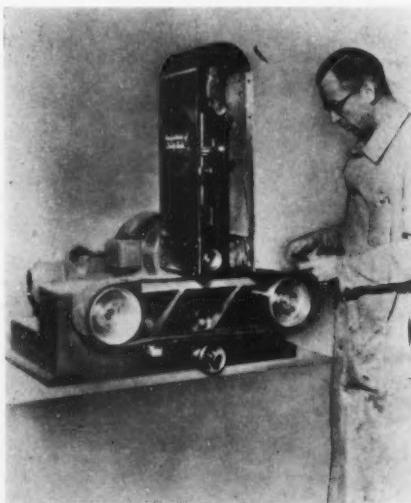
No. 11 Self-Operating Regulators, plus their years of reliable control plus availability of SERVICE, in 60 Cities, if required,—are reasons why equipment manufacturers like to use POWERS No. 11 regulators shown above. Bulletin 329 describes their many points of superiority. Write for a copy. (c5)



THE POWERS REGULATOR CO.
Skokie, Ill. • Offices in 60 Cities • See your phone book

Over 60 Years of Automatic Temperature and Humidity Control

THE POWERS REGULATOR CO. OF CANADA LTD.
Toronto, P. O. Box 182 Weston • Offices in Chief Cities



The drive motor for the conveyor belt of the 304C is an infinitely variable speed, 3 to 1 ratio, one-third HP motor, permitting complete flexibility for various types of work. The drive motor for the spring tensioned coated abrasive belt is one and one-half HP and drives at 3,600 R.P.M. The 4 inch wide, 54 inch belt can be changed and tracked in a few seconds. A hand wheel at the front of the machine adjusts the grinding head for variations in stock thickness and regulates the grind pressure.

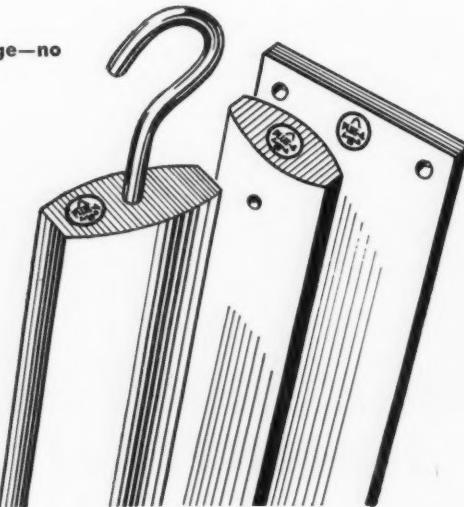
Multiple grinding heads for rough to finish grinding operations can be provided at a low additional cost.

Now... get more for your anode dollar!

NEW ANACONDA "PLUS-4" ANODES*

(PHOSPHORIZED COPPER)

- + 1 Freedom from anode sludge—no "bagging" or diaphragms required.
- + 2 No copper build-up in solution.
- + 3 Exceptionally smooth, heavy cathode deposits.
- + 4 10% to 15% more cathode deposits per pound of anode.



It has been discovered that carefully controlled amounts of phosphorus, together with minute amounts of other elements in electrolytic copper, make anodes of vastly superior quality for acid plating. ANACONDA "PLUS-4" Anodes are available in all the standard sizes and forms at no increase in

cost over ordinary anodes. Look for the stamp "PLUS-4" on the anodes you buy.

We'll be glad to supply additional information, in detail, without obligation. Just write to: The American Brass Company, Waterbury 20, Conn.

*For use under Patent No. 2,680,216

54160

ANACONDA®

"PLUS-4" ANODES

Made by THE AMERICAN BRASS COMPANY

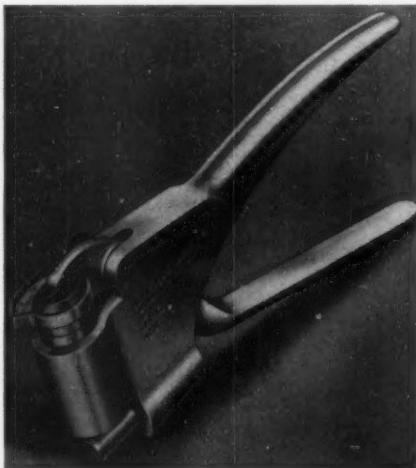
Hardness Tester

Webster Instruments, Inc., Dept. MF, 11856 Mississippi Ave., Los Angeles 25, Cal.

The new Model BB-75 hardness tester which tests soft materials, even electrodeposited copper in the Rockwell E20 to E100 range, was developed to meet the need of the phonograph record industry for a quick, easy, and accurate method of testing the hardness of electro-deposited copper, and copper in the low hardness range. However, construction of the tester permits the user to test other common materials comparable in softness to fully annealed copper.

The new device features one-hand operation, a round anvil which permits testing of round, square, irregular and

tubular shapes within its $\frac{1}{4}$ " capacity, extremely simple operation and rugged construction. It is easy to use and re-



quires no special skill or training.

Accuracy of readings is not dependent upon the operator's skill. The test is made by simply placing the material being tested between the anvil and housing, and applying pressure to the handles until the housing contacts the material. Degree of hardness is then read from the dial indicator. This reading can be correlated by means of a graph to a Rockwell E hardness scale.

Corrosion Resistant Paint

Speco, Inc., Dept. MF, 7308 Associate Ave., Cleveland 9, O.



An improved type of Chem-Rem, acid and alkali resistant black paint is said to have substantially greater covering capacity than its predecessor material. This is reputed to make possible effective one coat coverage, instead of the multi-coat process previously recommended. Greater water repellence and added luster through the inclusion of silicone in the paint formula, are other features claimed.

The paint is recommended for both interior and exterior use on metal, masonry or wood. It withstands attacks of acetic and hydrochloric acids, dilute sulphuric acid, or mixtures of these acids. It is particularly recommended for locations where smoke and chemical fumes are prevalent.

The paint can be applied by brush, spray or dip. Its glossy black finish dries to the touch in 3 hours and sets in 10 hours. It is intended for use as a finish coat and will bleed through other paints.

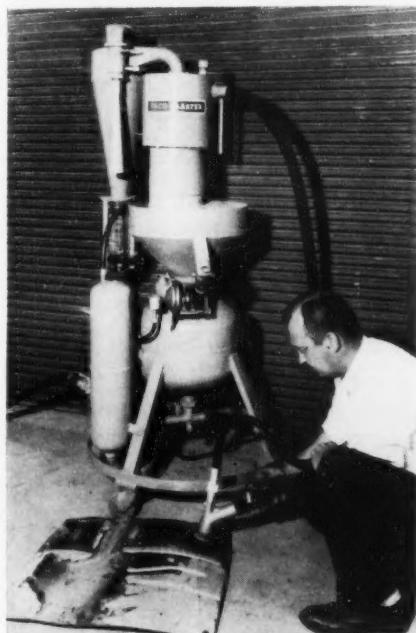
The coating is also said to be im-

pervious to moisture, elastic and unaffected by temperature changes. The manufacturer advises that it has high resistance to oil or oil fumes.

Abrasive Blasting

Vacu-Blast Co., Inc., Dept. MF,
Belmont, Cal.

The new Vacu-Blast Utility Model is an intermediate sized machine, with faster cleaning rates than the Vacu-Blast, Junior, and yet moderately priced. Advantages over regular open blast cleaning are: no flying dust, reuses abrasive (steel grit) and is completely portable.



Prices are: \$1,650-\$1,975, depending on size of pressure tank. A free demonstration will be given by company representative in major cities on request, providing customer has 100 cu. ft. of air per min. available.

Die-Cut Pressure-Sensitive Tapes

Printed Cellophane Tape Co., Dept. MF, 521 No. La Brea Ave., Los Angeles 36, Cal.

Die-cut pressure-sensitive tapes have been developed to precisely mask out unusual shapes or to protect holes and apertures during manufacturing operations. Precision cut to the custom made specifications of each masking job, these handy masks assure sharp-line masking during painting, plating, buffing, polishing, stenciling, and sand-blasting. Die-cut masks are supplied in rolls and are mounted on a "quick release" paper backing for fast application.

Start the New Year Right!

Count On
SPEEDIE SATIN FINISH
Every Time!



There must be a reason! Sales of SPEEDIE Satin Finish are going up, Up, UP! . . . by the proverbial leaps and bounds. What's the reason? SPEEDIE Satin Finish really sticks to the wheel — giving a finish that is unmatched. Here's one way to save money on *your* greaseless . . . and you'll like to use SPEEDIE Satin Finish — because it is colored red, enabling the buffer to know at all times how much compound he has on his wheel . . . a second SPEEDIE method of saving you dollars.

SPEEDIE Satin Finish is available in all size grits, from No. 80 for polishing, through No. 400 for the finest finish. Here is a uniform product well worth investigating.

Write today for samples of SPEEDIE Satin Finish, advising grit size and number of tubes required. And inquire about the complete line of efficient and economical SPEEDIE Buffing & Polishing Compositions.



Polishing Room Supplies and Equipment

THE BUCKEYE PRODUCTS CO.

7033 Vine Street Cincinnati 16, Ohio

Cable address: Buckprod

Also available as a stock item are die-cut circles known as "Flash-off" masks, overlapping each other slightly on the roll, several at a time may be removed. Stock diameters range from $\frac{1}{4}$ " circles to $1\frac{1}{2}$ " circles.

Sizes from 20" x 40" down can be



furnished in irregular shapes or sizes to meet specifications.

Indicating Temperature Control

Burlington Instrument Co., Dept. MF, 16 River Road, Chatham, N. J.

The new indicating temperature control Model LD-1S is an entirely new idea in indicating instruments. Designed for both laboratory and industrial use, it combines an independent dial thermometer with a differential expansion type temperature control.

Several adjustable temperature ranges are offered, including 150-750°F. Control is obtained by the differential expansion of two concentric tubes actuating a snap-acting

Cr | 3

In deciding upon the brand of Chromic Acid to use, successful platers consider three factors:

- 1 — Purity of the product as indicated by the assay and maximum limits of impurities.
- 2 — Experience and technical competence of the producer.
- 3 — Reliability of the manufacturer as demonstrated during periods of shortage.

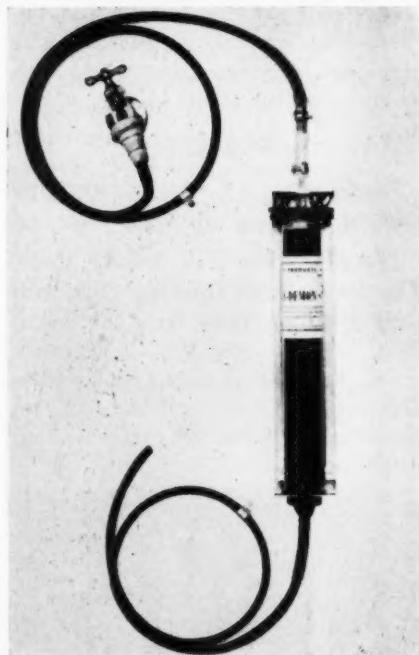
More Mutual Chromic Acid is used than any other brand because the metal finishing industry has found Mutual's record to be outstanding on all three counts.

**CHROMIC ACID · SODIUM BICHROMATE
POTASSIUM BICHROMATE**

MUTUAL CHEMICAL CO. OF AMERICA
NEW YORK, N.Y.
U.S. PAT. OFF.

SINCE 1845

MUTUAL CHEMICAL COMPANY OF AMERICA
Mutual Chromium Chemicals
99 PARK AVENUE · NEW YORK 16, N.Y.



according to the above manufacturer. Therefore, it performs with the same economy as any larger size permanent cartridge type demineralizer, and the initial cost is extremely low.

The demineralizer consists of:

1. Cartridge of clear unbreakable tubular plastic with removable top cover for simplicity and attractiveness, packed with built-in porous stone filter and fiberglass screen.
2. Inlet and outlet connectors with rubber hosing.
3. Aluminum bracket for attachment to wall near tap.

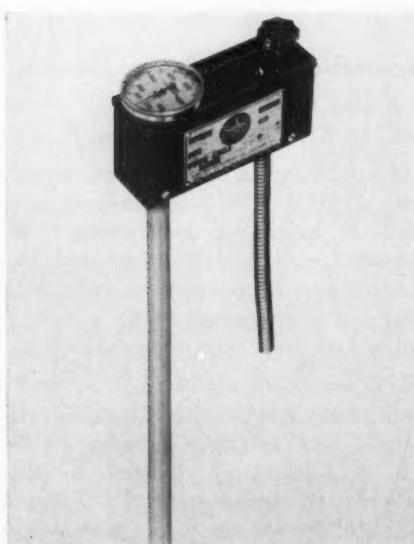
The ion-exchange material can be easily removed and the device refilled with fresh material.

Self-Contained Blast Unit

*The W. W. Sly Mfg. Co., Dept. MF,
4700 Train Ave., Cleveland, O.*

Combining a blast cabinet and dust collector in minimum space, the new Blast-Filter Combo is claimed to offer advantages never before obtainable in cleaning small metal parts (both ferrous and non-ferrous). It can be adapted also to soft grit blasting.

Designed to fit against a wall or in a corner, the unit occupies a minimum of floor area, is only 2' 6" deep by 3' 3" wide with the blast cabinet chamber of the same depth and width by 26" high. The height of the work area has been planned for greatest efficiency. The unit is easily accessible from two sides. The easy-lift overhead door requires no additional space. Automatic spring assures positive ac-



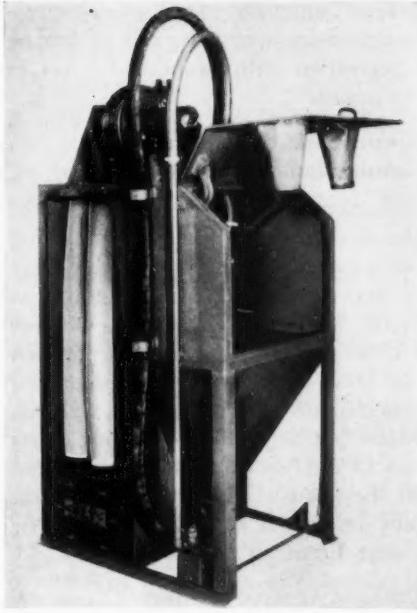
switch through a lever. Switch is rated at 15 amp, 125-250 volts, a.c. Operating differentials are from ± 1 to 4°F , depending on conditions.

This control is for local mounting and may be furnished with flange or threaded fittings. Tube is of brass or stainless steel, $5/8$ " O.D. x 14" long. Instrument head measures 5" x $1\frac{3}{4}$ " x $2\frac{1}{2}$ ", exclusive of knob and thermometer dial.

Permanent Cartridge Demineralizer

*Enley Products, Inc., Dept. MF,
1236 Broadway, Brooklyn 21, N.Y.*

The Perma-Demon is the only water demineralizer of its size which does not require cartridge replacement



tion. Operation is simple and easy by a spring treadle—a slight pressure of the foot starts it; lifting of foot stops it.

The unit has an integral suction cloth-type dust collector. The illustration (with inspection door removed) shows the filter and its easy access. An outstanding feature is filter cleaning of air before reaching the fan thereby protecting the fan from wear. The dust hopper is available by merely unfastening five wing nuts.

Quartz Thermostat

*N. J. Thermex Co., Inc., Dept. MF,
533 Bergen St., Harrison, N. J.*

A new quartz thermostat, immune to chemical attack but extremely sensitive to temperature, consists of an outer chemically resistant quartz tube and a contained liquid which actuates the contact mechanism by expansion and contraction resulting from temperature changes.

These quartz thermostats provide high capacity and are ideal when space is limited. Their rating is 5,000 watts at 120-240 volts. Operating temperature range may be adjusted by a dial. The thermostat tube can be supplied in lengths from 6" to 36".

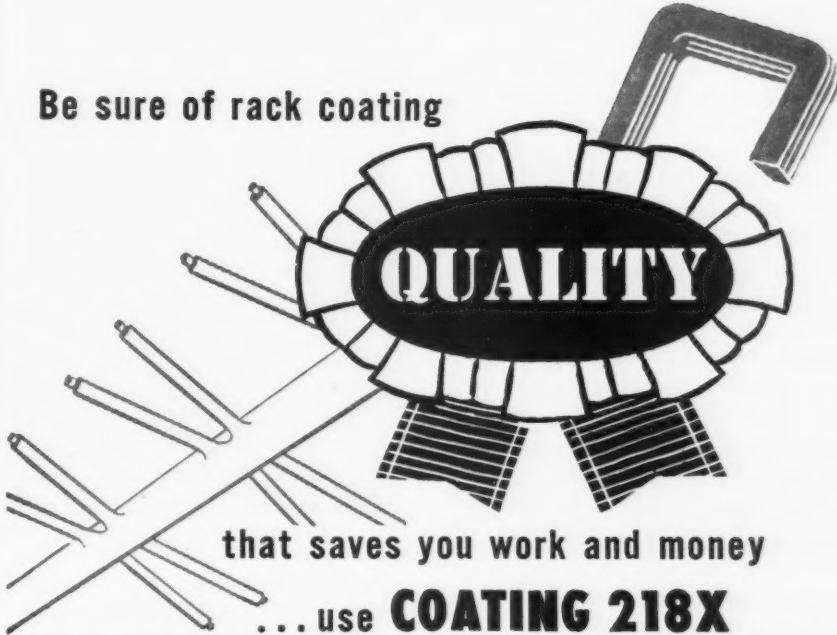
The present price range of these units is from \$22.00 to \$26.00 depending on the style.

Alkaline Powder for Rust, Scale, Paint Removal

*Kelite Products, Inc., Dept. MF,
1250 N. Main St., Los Angeles 12, Cal.*

Kelite Process 235 is a dry powder which, in water solution, removes hard

Be sure of rack coating



that saves you work and money

... use COATING 218X

IN plastisol Unichrome Coating 218X you get genuine quality which quickly shows up on the job. It withstands all plating, anodizing and cleaning cycles—even those with vapor degreasing cycles. This keeps coating costs at bedrock, simplifies racking. Coating 218X won't contaminate even the "fuzziest" of plating solutions—thereby avoiding future trouble and costly downtime.

This resilient coating doesn't chip, crack, blister. It rinses freely, cuts

dragout, minimizes drag-in. Little wonder that Coating 218X is used so widely by cost-conscious platers.

Remember, Coating 218X is produced by United Chromium . . . the only company that has: (1) Developed plating processes; (2) Given service on plating problems; (3) Ten years experience in formulating highly corrosion-resistant plastisols . . . and therefore knows what quality a rack coating needs for most economical plating service.



COATINGS for METALS

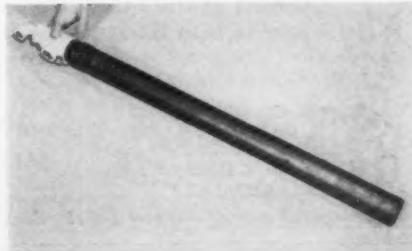
Products of UNITED CHROMIUM, INCORPORATED

100 East 42nd St., New York 17, N.Y. • Detroit 20, Mich. • Waterbury 20, Conn. • Chicago 4, Ill.
Los Angeles 13, Calif. • In Canada: United Chromium Limited, Toronto 1, Ont.

water scale, rust, and paint from ferrous metals. At a concentration of 3 lbs. per gal. of water at temperatures of 180-212°, the process is claimed to assure virtually complete removal of rust in 30-40 minutes. No current is used and the material is non-acid. In fact, the pH is exceptionally high yet the material is safe on all ferrous metals and the rate of attack on copper is low. Lead, zinc, and aluminum are subject to deleterious attack.

Plating Barrels

Claims made in a Recent Development item on a plating barrel, which appeared in the July 1954 issue, were those of the manufacturer and not the opinion of this publication. This policy applies with regard to all items reported in this section each month.



Karbate tube is heavily fiberglass reinforced for greater strength.

The bayonets have an excellent rate of heat transfer hence units have large capacity in relation to size. They can be used for either cooling or heating or alternately for both, since the material is not affected by thermal shock.

Units can be provided in any length up to 6' and are shipped from stock. Improved design makes lower prices possible.

Data sheets including capacity nomographs are available upon request from the manufacturer.

BUSINESS ITEMS

Kocour Appoints New Michigan Representative

The Kocour Company of Chicago, Ill., manufacturers of buffing, and polishing compositions, rectifiers, analytical sets and instruments, and distributors of Roberts Rouge Company's greaseless and finishing compounds, announces the appointment of a new



Norman K. Meyers

sales representative, *Norman K. Meyers*, in the state of Michigan.

Meyers will operate from his home at 2140 Brickley, Ferndale, Mich. and will service the area within 150 miles of Detroit. He is well prepared to service this area with a background of nine years of diversified plating and metal finishing experience. He has served in such capacities as chemist,

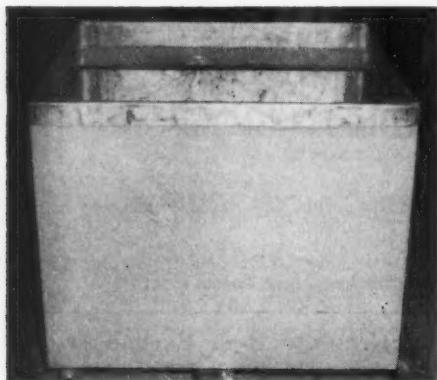
process engineer, production supervisor, research and the sale of buffing composition with prominent firms in the industry.

Comeco, Inc. New Name of Connecticut Metalcraft, Inc.

Enthone, Inc., manufacturers of chemical products for metal finishing has announced a change in the name of its division formerly known as *Conn. Metalcraft, Inc.* The new name will be *Comeco, Inc.* This corporation has been engaged in the design and manufacture of plating racks, fixtures, filters, plastic tanks, ventilating ducts and in the sale of general equipment for the electroplating industry. *Comeco, Inc.*, is located at 442 Elm St., New Haven, Conn.

Technic Opens Chicago Office

For the convenience of electroplaters of precious metals in the Midwest, *Technic Inc.* has opened an office at 7001 North Clark St., Chicago 26, Ill. Growing use of electroplated precious metals for industrial, scientific and decorative applications prompted the step, according to company officials,



For all lead linings--extra heavy welds

THAT'S the way to add long-life utility value to lead lined tanks. Start with a Stortswelded tank, properly designed for the purpose and expertly welded. Then have the linings installed in the Storts lead shop, where custom jobs in lead linings are a specialty.

STORTS
WELDING COMPANY
INCORPORATED

Manufacturers of Welded Fabrications to Specification

38 Stone Street
MERIDEN, CONN.



They're looking over the new "automation concept" Stevens Stevadoer which will be announced soon. Plan now to see this great new addition to the complete Stevens line of automatic metal finishing equipment. *Frederic B. Stevens, Inc., Detroit 16, Michigan.*



For PLATERS, SILVERSMITHS, JEWELRY MFGRS., makers of Watches, Clocks and Electronics and other metal finishers. Supplied in straight or crimped brass, steel, nickel silver or stainless steel wire in sizes .0025 - .006 and in bristle, fibre or Nylon. Special sizes and shapes to order.

Write (Dep't. M) on your letterhead for catalog and price list.

DIXON & RIPPET, INC.

KINGSTON, N. Y.

to provide prompt on-the-spot service in Chicago and surrounding areas.

Informative technical data sheets giving complete facts about each of the company's products are available on request from either the new Chicago office or at 39 Snow St., Providence 1, R. I.

Gillett Joins Merit Products

Merit Products, Inc., announces the appointment of *William G. Gillett* as works manager of the Culver City plant in California. Gillett will supervise production of Sand-O-Flex contour sanders and Grind-O-Flex flexible grinding wheels. He comes to the firm from Ferguson Overhead Doors, Los Angeles where he was superintendent of operations. Previously he was with Kimball Industrial Elevators. Gillett received his training at Ford Motor Trade School in Detroit.

Heil Celebrates 25th Anniversary

This huge cake commemorating the 25th anniversary of *Heil Process Equipment Corp.*, Cleveland, Ohio, is being cut by *Carl E. Heil*, president



and founder, in the presence of the company's many employees and guests.

Mr. Heil paid tribute to his employees and customers for the progress the company has made during the past quarter century, and was vigorously confident of the future by emphasizing the great advancements that science and technological developments are unfolding daily to better serve the needs of America's industry and its people.

Electro-Glo Appoints LaSaleco

John Jumer, president of *Electro-Glo Co.*, Chicago has announced the appointment of *LaSalco, Inc.*, St. Louis manufacturer of equipment for the electroplating and polishing field, as a distributor for Electro-Glo electropolishing concentrates effective January 1st.

J. S. Hubbard-C. J. Martin New Wyandotte Chemicals District Sales Managers

James S. Hubbard, Boston, and *Charles J. Martin*, Buffalo, are newly appointed sales managers of *Wyandotte Chemicals Corp.* district offices. Both appointments were effective January 2, as announced by *Fred Tholen*, sales manager of the *J. B. Ford Division*.

Mr. Hubbard, a native of Richmond, Virginia, has represented the company as a salesman for 6 years. His previous business connections were General Motors, Atlantic Coast Line Railroad and two well known Wyandotte Chemicals jobbers, Virginia-Carolina Laun-

BEAM-KNODEL CO.

Metropolitan Distributors

HANSON-VAN WINKLE-MUNNING CO.



Complete Service for Metal Finishing

Products Listed Below Available in New York
Stock With Reasonable Exceptions

GENERATORS

Anodes, All Kinds

- Tallow
- Nickel Salts
- Brushes
- Copper Salts
- Buff
- Cyanide
- Chemicals
- Tanks, All Kinds
- Tripoli Comp.
- Plating Barrels
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- Emery Paste
- Polishing Wheels
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195 LAFAYETTE ST., COR. BROOME
Phone CAnal 6-3956-7 NEW YORK 12, N. Y.

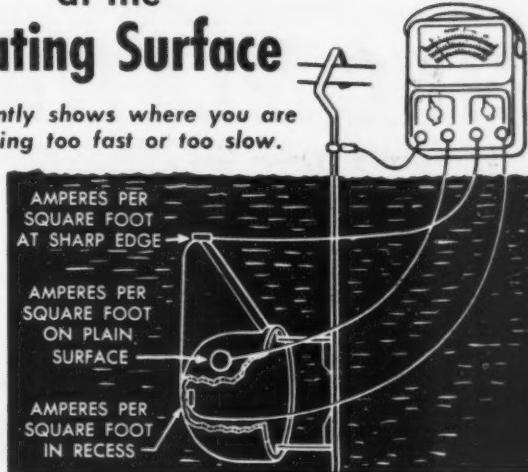
FILTERS

MAIZO
Drying
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LEA Buffing
& Polishing
PRODUCTS

Measures Current Density at the Plating Surface

Instantly shows where you are plating too fast or too slow.



Yes—the BELKE-KOTZ Meter eliminates guesswork—delays—spoilage—and tedious measurements. Shows instantly current density at three selected locations on the article—with the article in any position.

NO FIGURING. Meter shows amperes per square foot—affords direct comparison with current density table for the solution you are using. Eliminates trial and error. Enables you to plate to specifications at lowest cost.

Ask your BELKE Service Engineer or write—

BELKE

MFG. CO., 947 N. Cicero Ave., Chicago 51, Ill.
EVERYTHING FOR PLATING PLANTS



J. S. Hubbard

dry Supply and Sterling Supply of Philadelphia.

Mr. Martin, a native of New York City, has represented the company in that area for over 6 years. He has studied at New York Business Institute, served 5 years in the U. S. Coast Guard, has worked for an auto-truck body manufacturer and assisted in the merchandising and erecting of some of the first all-steel homes.



C. J. Martin

Both Mr. Hubbard and Mr. Martin have thorough and practical field experience in the many different industries served by the firm's cleaning, washing, germicidal, metal cleaning and absorbent products. Both new managers have recently been given intensive refresher training at the chemicals research and technical service laboratories.

Graver Opens New District Office

H. T. Sulcer, vice president and general manager of *Graver Water Conditioning Co.*, announces the opening of a new Texas District Office at 5343 McCormick St., Houston, Tex. This district office will be managed by James J. Hanratty and will serve all of New Mexico and Texas except the northern part of the Panhandle.

Mr. Hanratty has been with the company for many years and is very well versed in all phases of industrial and municipal water treatment and industrial waste treatment. He holds both a chemical engineering and a business administration degree.

Roberts Rouge to Service Electronic Thickness Tester for Kocour

The *Kocour Company* of Chicago, Ill., has just announced new service facilities for their Electronic Thickness Tester for users of this instrument in Northeastern United States. The *Roberts Rouge Company* of Stratford, Conn., will now service all testers in the following states:

Maine, New Hampshire, Vermont,

**Insure successful, economical,
uninterrupted**

ZINC PLATING

by purifying cyanide zinc plating solutions

with

McKeon's

Zinc-Brite

TRADE MARK REG'D.

No Other Purification Treatment Required.

Simplifies Zinc Plating Procedure.

Substantially Reduces Overall Plating Costs.

WRITE - PHONE - WIRE

Sulphur Products Co. Inc.

228 McKeon Way
Greensburg, Pa.

FASTER, BETTER

FINISHING

WITH

HARRISON'S

NEW

4A

BUFFING AND POLISHING COMPOUNDS

You send us sample of metal used. We will return finished sample together with compound for your specific requirements. Speed up productions with correct compositions.

HARRISON & COMPANY, INC.
HAVERHILL, MASSACHUSETTS

Massachusetts, Connecticut, Delaware, Rhode Island, New York, Maryland, Virginia, New Jersey, Pennsylvania, (east of the Susquehanna River).

Personnel have been thoroughly trained and properly equipped. Parts and test solutions will be stocked in Stratford and available to customers in this area.

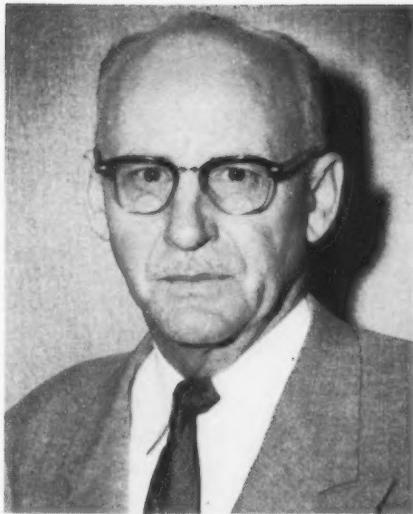
This new arrangement will not only make service more readily available, it will also reduce transportation costs.

Barker Bros. Appoints Representative

Barker Bros., Inc., announce the appointment of *Ben F. Leckron* of Indianapolis as their buff and polishing wheel sales representative for the state of Indiana.

Situated in the center of the state, Mr. Leckron will be in an excellent position to service the entire state in a prompt and efficient manner.

Ben Leckron has spent the last nine years servicing the finishing industry and has concentrated his efforts on buffs. He is familiar with buffering and polishing methods and has made



Ben F. Leckron



R. T. Clunan

it his policy to give as much help as is possible to the accounts he calls on. Prior to entering the metal finishing field, he had spent two years in mechanical engineering.

Deming Appoints Clunan

The Deming Company, Salem, Ohio, manufacturers of commercial water systems and industrial pumps, has

appointed *R. T. Clunan* as district representative in the Mid-Atlantic States.

Clunan joined the company in 1942. He worked in various departments in the factory for five years and served three years in the U. S. Navy during World War II. He is well versed in the mechanics, selection and performance ratings of all company products.

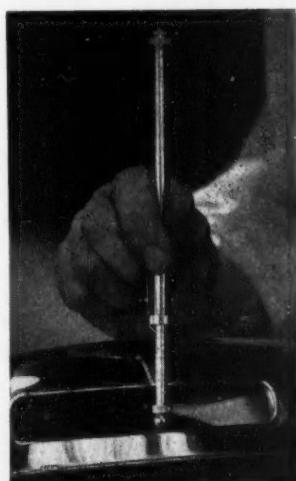


A magnetic thickness tester ...

POCKET HANDI-GAGE

FOR ELECTRODEPOSITED, HOT DIPPED OR PAINTED COATINGS ON STEEL

Tests thicknesses from 0.0001 to 0.015 inch. Each individual gage is separately calibrated to National Bureau of Standards thickness plates, resulting in an accuracy to 10% for thicknesses over 0.0002 inch. As simple to use as an automobile tire gage, the Pocket Handi-Gage may be used on the production line or in the lab. It's perfect as a "Go, No-Go" thickness gage at the plating tank or spray booth.



NO BIGGER THAN A FOUNTAIN PEN, BUT WHAT A JOB IT DOES!

Tests brass, cadmium, copper, lead, nickel, silver, tin, zinc, lead-tin and zinc-tin alloys, hot dipped tin and zinc, paint, plastic laminations, enamel and lacquer on steel and other magnetic metals. Gives results in SECONDS. Especially adapted for hard-to-reach areas. Comes in a pocket-sized case complete with magnets for various thickness ranges.



59 E. 4th STREET
NEW YORK 3.
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UNDER ONE ROOF

J. Holland & Sons offers you the most comprehensive operation in the entire finishing industry. Because we maintain one of the world's largest in-stock supplies of finishing equipment and supplies, we can deliver in-stock merchandise immediately upon your request.

You can forget about the problems of buying your requirements from numerous sources. Get dependability, complete satisfaction and "one-stop" buying from under our large roof!

Our engineering and technical staff is ready to assist you in solving special problems. We'll be glad to help!

J. HOLLAND & SONS, INC.

leaders in finishing equipment for over half a century
475 KEAP ST. (corner Union Ave.) BROOKLYN 11, N.Y.

For the past two years, he has handled sales and correspondence in all fields from the main office.

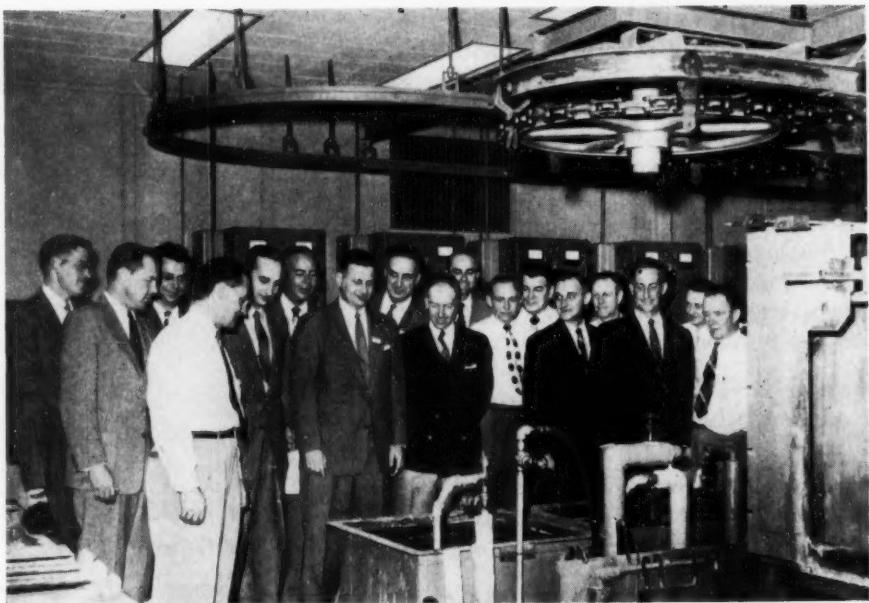
Clunan will call on company distributors and dealers and will also work on specific pump applications for industry. He is particularly skilled in water systems.

He will maintain a temporary office at Salem and will locate a permanent office on the east coast in early 1955.

Wyandotte Chemicals Representatives Attend Week-Long Service School

Aimed at continuing the best possible service to customers, the *Wyandotte Chemicals Corp.* industrial representatives shown in photo recently attended a week-long "refresher" school. The photo shows in background research laboratories installation of 18 cleaning, electrocleaning and electroplating tanks. At far right is the feed end of multi-stage industrial spray washer. Only the first of the seven inter-changeable units is pictured.

Those attending the school were,



left to right: R. Esten, Los Angeles; D. Booth, Chicago; J. Hennessey, Philadelphia; Andrew Liger, in charge of Industrial Research Laboratories; Ed Kubis, Technical Service Department; L. Coates, San Francisco; W. Mazan, Cleveland; F. Daly, Boston; J. Harden, Montreal; W. Lee, Atlanta;

H. Skinner and Oscar Anderson, Research Laboratories; E. Bartos, Detroit; R. F. Warkow, Research; E. Bedard, San Francisco; L. McCoy and A. Hannah, Research Laboratories. R. J. Racine, manager industrial sales and C. T. Dumont, Cincinnati, not present when photo was taken.

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Liquid buffing compound
since 1945

★ **NUGLU**
Cold flexible glue
since 1937

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Grain and Nuglu mixture
since 1941

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Self-priming Model LSIN-10 . . .
Cap. 100 gal/hr. H.T. Lucite
Filter Assembly. Stainless pump
. . . totally enclosed Motor . . .
portable . . . Wt. 60 lbs. . . .
14"x16"x16" high.

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Write for literature.

PARTIAL LIST OF MODELS

Model	Rated Capacity	Overall Size	Weight
LSI-5	50 gal/hr	11"x14"x12"	30 lbs.
LSI-10	100 gal/hr	12"x16"x16"	40 lbs.
ASI-300	300 gal/hr	2'x2'x2'	125 lbs.
ASI-600	600 gal/hr	2'x2'x2'	150 lbs.
RLS-1200	1800 gal/hr	2'x3'x3'	300 lbs.

SERVICE . . . Filters practically any acid or alkaline solution from pH 0 to pH 14; removes particles down to one micron in size. Strainer stops metallic objects.

DESIGN . . . Filter Assembly fabricated of stainless steel 316, high temperature lucite, rubber-lined, Haveg or Sethrin* resin. Filter Tubes of cotton dynel, porous stone or porous carbon. Pumps fabricated of Hastelloy, stainless 316 or plastic; centrifugal or self-priming. Motors drip-proof, totally enclosed, or explosion proof, 110 or 220 volt, single or three-phase, 50 or 60 cycle, sleeve or ball bearing. Hose — special acid and alkali resistant. Base — Linen Phenolic laminate on rubber tire ball bearing casters.

Sethco MANUFACTURING COMPANY
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National Research Appoints Minault

The appointment of *S. Sydney Minault* as general manager of the Equipment Division has been announced by *R. S. Morse*, president of *National Research Corp.*, Cambridge, Mass.

Mr. Minault has previously served as production manager and later vice-president and general manager of Tracerlab, Inc.; chief product engineer, camera plant manager, and later chief engineer of Ansco; methods supervisor, and later manufacturing engineering superintendent of Sperry Gyroscope.

He was born in England, reared in France, and educated at the University of Paris, Ohio State University, and Brooklyn Polytechnic Institute. He is a member of the American Society of Mechanical Engineers and the Instrument Society of America.

H-VW-M Vice President Honored on 25th Anniversary

John A. Bauer, vice president and member of the board of directors of *Hanson - Van Winkle - Munning Co.*, Matawan, N. J., was honored on the



John A. Bauer, vice president of Hanson-Van Winkle-Munning, receives a presentation from Louis M. Hague, president, at a dinner in New York honoring Mr. Bauer on his 25th anniversary with the firm. Taking part in the proceedings are Dr. Rufus E. Zimmerman, a director (left) and Van Winkle Todd, chairman of the board of directors (right).

occasion of his 25th anniversary with the company.

At a dinner on Nov. 30 at the Princeton Club in New York, he was presented with a silver cigarette box

inscribed with the signatures of the members of the board of directors. The presentation was made by *Louis M. Hague*, president, and the dinner was attended by members of the board.



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- #3-Black — Gives a rich, jet black finish as well as excellent protection.
- #4-Brighteners — Zinc barrel brighteners which are simple to control, very economical and give an exceptional lustre.

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This kit offers a new simplified method for rapid checking of zinc, cadmium, copper, brass and nickel solutions; acids and cleaners.

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Mr. Bauer, a resident of Matawan, came to the company as advertising manager and has since held various executive sales positions. He was appointed vice president in 1948.

DeFilippis Joins Lupoline

Joseph R. DeFilippis has joined the *Lupoline Automatic Polishing Equipment Corporation* as of December 1st, 1954. He will have full charge of the machine and assembly shop.

Mr. DeFilippis, a tool engineer with over 30 years of experience in the machine building business, will put into good use his machine tooling and designing experience.

Mr. DeFilippis will be in full charge of production and *Joseph Lupo* will be in charge of the research and development laboratories.

Loengard Appointed V.P. of Metal & Thermit

H. E. Martin, president of the *Metal & Thermit Corp.*, New York, announced the appointment of *Richard O. Loengard* as vice-president.

Mr. Loengard joined the company in 1919 and, subsequent to 1926, was



Richard O. Loengard

active in the management of affiliated and subsidiary companies in the chromium plating and metal coating fields. He has been president of *United Chromium, Inc.* since 1945 and will continue in this capacity as well as that of vice-president of Metal & Thermit.

Attendance Record

It has recently come to our atten-

tion that *Edward J. Musick*, a well known figure in plating circles, is also a faithful Rotarian—so much so, in fact, that he hasn't missed a meeting of the St. Louis Downtown Rotary Club for over 31 years. He has a string of over 1,600 meetings to his credit. Mr. Musick even went so far as to cancel a trip to Jamaica when he found that there was no Rotary Club there. Who knows, he may well set a world record some day.

Stokes Establishes New International Division

All overseas activities of *F. J. Stokes Machine Co.* will be administered and controlled, effective January 1, 1955, by a new International Division which has been established at the company's headquarter at 5500 Tabor Road, Philadelphia, Pa. While the firm's sales will still be handled through local representatives throughout the world, the new division will enable the company to establish closer control over and better relations with these representatives and thus given better service to its overseas customers.

The division will be directed by *Charles V. Nicholson*, who joined the

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for Wheels and Belts

MEETS TOUGHEST ABRASIVE GRAIN BONDING REQUIREMENTS

The purpose of a bonding cement is to hold abrasive grains firmly in position. It's as simple as that—and when we claim that GRIPMASTER will hold grains better than conventional cements, we mean it. But to convince yourself, why not place a small trial order—for a 75 pound pail or the packaged unit (4 one gallon cans).

Our distributor nearest to you has GRIPMASTER in stock and when we ship your trial order we'll let you know where you can reach him. Or, if you prefer to obtain the trial order through him, write or phone us and we'll let you know where he is located.

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WE WANT new products to sell. We want new ideas to develop for the national metal finishing market. Our active sales force is your assurance of volume. Our successful launching of new products such as anodes, automatics, filters, and rectifiers has given us the experienced background to market your line. Our technical staff will develop or service your product, our manufacturing facilities will produce it, and our sales organization will distribute it nationwide with profit and protection for you.



The christening! The Stevadoer, the newest addition to the complete Stevens line of automatic plating and processing equipment, will be announced soon. Write us so that your name can be placed on our announcement mailing. *Frederic B. Stevens, Inc.*, Detroit 16, Michigan.



Charles V. Nicholson

organization this year as export product manager. Previously, Mr. Nicholson had been for 18 years with Henry Disston and Sons, Inc., rising from junior salesman to manager of the Export Division. He has traveled widely abroad and brings to the company a thorough knowledge of the world's markets.

Mr. Nicholson is vice president of

the Foreign Traders Association of Philadelphia and chairman of its membership committee. He has also been a member of the National Foreign Trade Council and the Export Managers' Club of New York.

New Behr-Manning Appointments

Elmer G. Schacht, president of Behr-Manning Corp., Troy, N. Y., has announced that *Edwin C. Evans* has been made vice-president and assistant general manager, and *William I. Clark, Jr.* has become assistant to the president in addition to his present responsibilities as secretary of the company.

Mr. Evans joined Behr-Manning in 1934 as a member of the sales analysis department. In 1936 he entered the purchasing department, becoming assistant purchasing agent in 1941 and purchasing agent in 1946.

In January, 1950, Mr. Evans became assistant to the vice-president in charge of engineering and manufacturing, and in October, 1952, he was made director of manufacturing. In January, 1953, he became vice-president of the company.

Mr. Evans attended Rensselaer



Edwin C. Evans

Polytechnic Institute, and the Advanced Management Program of the Harvard Graduate School of Business Administration.

Now residing in Troy, N. Y., he is a member of the board of trustees of Vanderheyden Hall, board of directors of Rensselaer County Chapter, American Red Cross, Troy Community Chest, and the Troy Country Club.

Mr. Clark joined the company in

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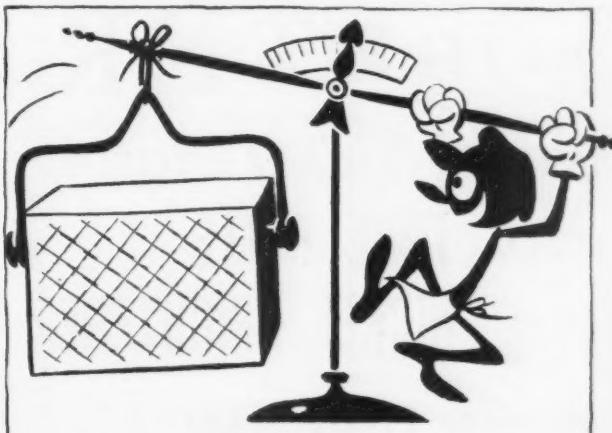
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THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.



Monel Pickling Equipment



William I. Clark, Jr.

July, 1933, as a credit clerk. He served as assistant to the controller from 1935 to 1942, at which time he became production manager of the aviation division. Mr. Clark was made assistant secretary of the company, personnel director and office manager in 1947. He was elected a director of the company in 1952 and was appointed chairman of the operating board in 1952 and in 1953.

He served as assistant clerk of Norton Pike Co., a Behr-Mannning subsidiary, from 1947 to 1952; assistant treasurer, 1947 to 1952; director of the company from 1949 to 1952; and was elected secretary of the company in 1952.

He is a graduate of Milton Academy and Harvard University and attended the Advanced Management Program of the Harvard Graduate School of Business Administration.

Mr. Clark, who now resides in Menands, N. Y., is a member of the board of governors of the Schuyler Meadows Club of Loudonville and is a director and member of the executive committee of the Albany County Tuberculosis Association. Mr. Clark is also a director of Trinity Institution, Albany, N. Y.

J. L. Bogus Addresses Electroplating Class

J. L. Bogus, technical service director of Jelco Finishing Equip. Corp., New York City, appeared as guest lecturer on Thursday, December 2, 1954 before the joint classes in electroplating at the Brooklyn Evening Technical High School. For the topic of his

lecture, nickel baths, the functional phases of some of the common types was emphasized. The smooth characteristic plate of the sulfamate bath, Mr. Bogus indicated, will change to a hard plate if chlorides are present; the all-chloride nickel bath is used for worn shafts and machinery because of the hardness of the deposit it produces; black nickel requires exact operating conditions for satisfactory results.

In the discussion of the Watts bath, some of the characteristic troubles as pitting, peeling, streaking, throwing power and brittleness, their causes and remedies were reviewed in a most thorough manner. Such high lights as improper cleaning cycles, observing men at their tasks, adequate rinsing, immersion plating effects, a four-hour carbon treatment, dummying, chelation and filtration were presented in a very lucid manner. The attentiveness of the members of the class throughout the extended talk was indicative of the trend toward an educational program, one that will meet the fundamentals so essential for effective interpretation of the technical advances in the plating industry. The question-answer period was a continuation of

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Increase Production

easy to control . . . cuts down on trouble that entails costly delays.

Save time

can be operated at a higher speed.

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gives unbelievable uniformity of deposit in recesses . . . brighter, white color.

Write for FREE bulletin revealing tricks on improving your nickel plating and cutting costs.

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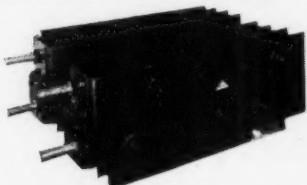
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Replacement Rectifier Stacks
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Magnesium copper sulphide rectifiers make your plating power supply more rugged and dependable. Magnesium radiator fins for fast heat dissipation and lighter weight. Matching pairs \$265.00.



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Model 4045—750 amps at 12 volts DC—1500 amps. at 6 volts DC. Operates on 208, 220 or 440 A.C. Weight 525 lbs. F.O.B. Indianapolis, Indiana.

SOME JOBBERS AND SALES TERRITORIES OPEN

ELECTRONIC RECTIFIERS, INC.

2102 SPANN AVENUE

INDIANAPOLIS 3, INDIANA

this stimulating session and the appreciation of the class was shown by an enthusiastic round of applause.

Nox-Rust Chemical Corp. Becomes Daubert Chemical Company

Nox-Rust Chemical Corp., Chicago, leading manufacturer of rust preventive products and automobile under-coating, has adopted a new name, effective January 1. Because of diversification of products, the firm chose the name *Daubert Chemical Co.*, after its president *George A. Daubert*. The company was founded in 1935.

The company will continue to market Nox-Rust rust preventive compounds and Vapor Wrapper through its Nox-Rust Division. The company's main plant is located in Chicago; other manufacturing operations are carried on at Baltimore, Maryland, and Martinez, Calif. Offices are located in principal cities.

Battelle Expands Research Facilities

The first units of facilities for an expanded program of pilot-plant and large-scale research for American in-

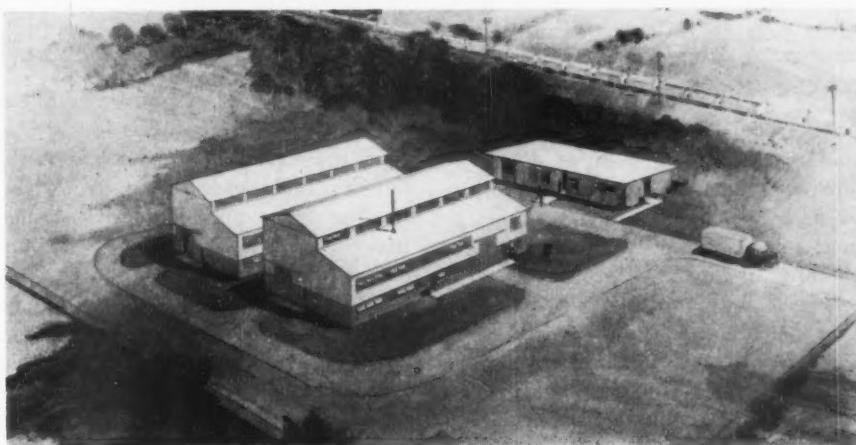
dustry are nearing completion at Battelle Memorial Institute's recently purchased 400-acre site just outside Columbus, Ohio. They will be ready for installation of equipment in the next 30 days.

The new facilities, according to *Clyde Williams*, Battelle's president and director, will be used primarily for large-scale studies in chemical engineering, metallurgy, and minerals processing.

Provided initially in the 300,000-

dollar construction program are two major buildings, totaling 13,000 square feet and designed specifically for large-scale experimental work. Ample water, natural gas, and electric power have been provided to meet any foreseeable pilot-plant need. Additional buildings are contemplated and will be custom built to fill specific industry needs as they arise.

Much of Battelle's expanded pilot-plant research will be guided by *John W. Clegg*, Manager, Department of



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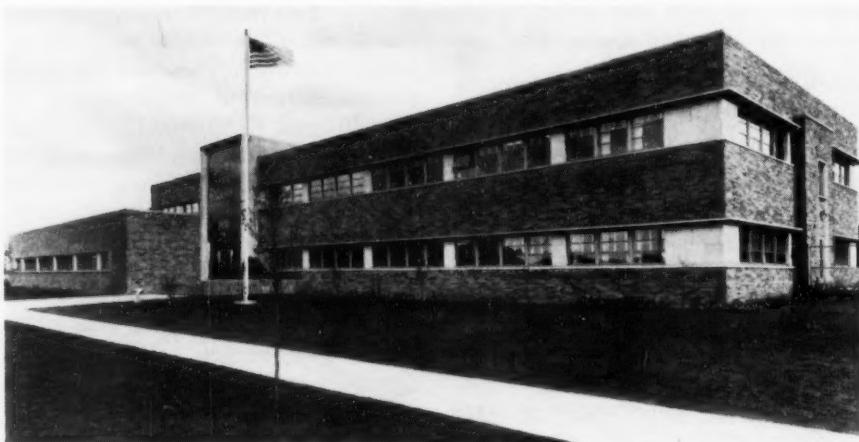
Chemical Engineering, *J. Harry Jackson*, Manager, Department of Metallurgy, and *W. H. Browne*, Manager, Department of Mechanical Engineering. All have been closely associated with the Institute's already extensive large-scale experimental studies.

The new construction at the West Jefferson (Ohio) site is in addition to the Institute's recently announced 1½-million-dollar program for the establishment of facilities for the study of peacetime applications of nuclear energy.

Cambridge Wire Cloth Co. Appoints Roche

The Cambridge Wire Cloth Co. announces the appointment of *Richard Roche* as personnel director. Mr. Roche has been associated with the company for the past fourteen years, serving in a number of capacities. He was closely associated with the woven wire conveyor belt dept. for nine years, acted as safety director, supv. of inventory and receiving for the past five years, and also supervised the first aid department.

Union Carbide Moves Cleveland Offices



After a number of years with offices in five different buildings, *Union Carbide and Carbon Corp.* has consolidated its Cleveland offices in a new, modern office building and distributing center at 1300 Lakeside Avenue.

The building is located on a plot of land large enough for possible future expansion. Part of it is a one-story office and stockroom, the other part is a two-story office building. It is of steel frame construction with brick masonry walls using Norman-

type bricks. The variation in the length of bricks and their range of shades from champagne pink to buff give the walls a pleasing and unusual appearance. The dominant architectural feature is the black Bonaccord granite entrance facade with the company name in stainless steel letters. Special features provided for the convenience of employees include complete air-conditioning, fluorescent lighting, ample parking facilities, and a lunchroom.

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New-Penny Bright!**

COP-BRITE

NEW, BRIGHT COPPER PROCESS

A One-Material Brightener

- Yields a faster, brighter finish
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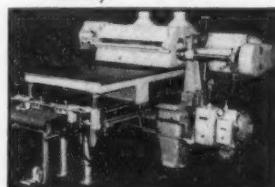
VERSATILE!

*It Floats
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The buffs literally ride on air . . . insuring uniform buffing pressures at any predetermined degree over flat or curved surfaces!

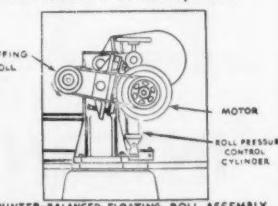
CLAIR SURFACE FINISHING MACHINES

Development of these Clair surface finishing machines is the answer to "demand-performances" from manufacturer's surface finishing departments for precision finishing machines of thorough capability and astonishing versatility.



MODEL 203 This design has anticipated the need for holding the work, with vacuum, regardless of use for surface finishing over the entire area without salvage.

- ★ Horizontal Design offers - - -
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- ★ Easier to exhaust and keep clean!



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MANUFACTURING CO., Inc., OLEAN, N.Y.

Offering the Most VERSATILE Line of Surface Finishing Machines

International Rack Co., Inc., Opens New Ohio Valley Plant



The International Rack Co., has been established to serve the Ohio Valley with engineered racks, fixtures, and accessories for plating and materials handling. The company, newest in the coast-to-coast Naraco fam-

ily, was opened in November to meet a persistent demand by Ohio Valley plating executives. Other Naraco companies are located in Paterson, Flint, Chicago, and Los Angeles.

Changes at Metal & Thermit Corp.

Metal & Thermit Corp., New York, announces several changes in its sales organization due to retirements and promotions. These changes, effective January 1, 1955 are as follows:

John B. Tinson, vice president and chief sales executive, who has been with the company since 1924, retires but will remain with the organization as a consultant.

Donald K. Morgan, formerly with the Kirby Machine Co., and a sales consulting engineer for several years,

is promoted to general sales manager. Mr. Morgan has been chief assistant to Mr. Tinson.

O. L. Howland, formerly manager of sales of the company's welding division is promoted to assistant to the general sales manager with headquarters in East Chicago, Ind. Mr. Howland for many years was district manager of the welding division in the middle-west and now returns as chief sales executive of the company in this area.

Merritt L. Smith, manager of advertising and sales promotion, assumes the additional duties of eastern assistant to the general sales manager, and will continue to make his headquarters at the company's main office in New York.

Robert T. Brown, former district manager in Pittsburgh, Pa., is promoted to the position of manager of sales of the welding division, with headquarters in New York.

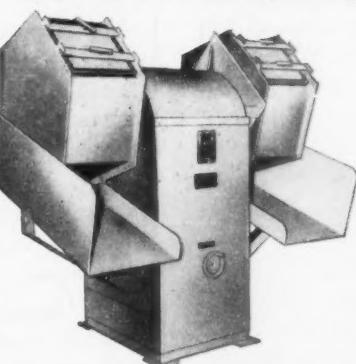
Kenneth H. Zeigler, sales engineer with the company in the Pittsburgh area since 1951, has been promoted to the post of district manager at Pittsburgh.

NEW!

RAMPE TWIN PRECISION BARREL FINISHER

Super Twin With Double Capacity

Provides larger volume capacity—4 cu. ft. (2 cu. ft. per barrel). Sturdily built and powered by a 3/4 H.P. 220/440 volt, 3-phase motor—Variable speed drive—Barrels can be vinyl plastic lined, if desired. Movable chutes act as safeguards when tilted to the rear. Tote boxes can be furnished in place of movable chutes.



Prices from \$735.00 to \$995.00 depending upon equipment.

OTHER RAMPE BARREL FINISHERS

Three other Rampe Barrel Finishers are available—2 single units and 1 Twin model. They range in price from \$99.50 to \$685.00, depending upon size and equipment.

Send for literature on the complete Rampe Line.

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3328 ST. CLAIR AVE. CLEVELAND 14, OHIO

A barrel load of bright nickel with a nickel's worth of

NICKELITE

CORROSION RESISTANCE UP 30% TO 100%

With Nickelite you can get 13 to 22 hours of salt spray exposure with 0.00006 inch of barrel nickel, instead of 11 to 13 hours. Actual salt spray tests show even greater improvement with thicker deposits. And you're saving money, too!

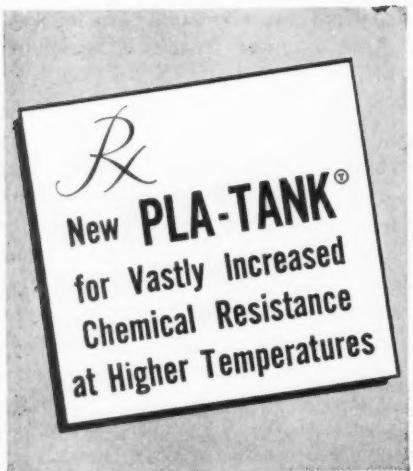
WRITE FOR FREE FOLDER ON MODERN BARREL PROCESSES



Concentrated to quadruple strength — you don't ship, store or handle water! Shipping weight cut 275% — no deposits, no carboy returns. Stable, efficient, easily stored, easily used — a capful of Nickelite is enough for a barrel load of nickel.

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NOW . . . The Chemical Corporation research and development program makes possible a "prescription" type of PLA-TANK formulation for specific problems. It is literally possible for our technical service engineers to prescribe one of a number of vastly improved combinations of PLA-TANK material for liquid contact applications never before considered suitable for ordinary polyester plastics.

For example, tests prove that all new PLA-TANK electro-platers' tanks now offer far better performance on hot sulphuric, nitric, phosphoric and chromic acid solutions than any other commercially available fiber glass tank.

Remember — All Polyesters are not Alike

PLA-TANK achieves these vastly improved resistances by carefully controlled variations in either the resin or fiber or both. Now more than ever "*all polyesters are not alike*" and COMMONLY PUBLISHED STUDIES OF POLYESTER PERFORMANCE MUST NOT BE APPLIED TO PLA-TANK SPECIAL MATERIALS.

Intensive research and testing covering thousands of samples have isolated and selected those alkyds which show highest chemical resistance to various specific agents and matched them with the most effective cross links.

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Benefit from continuous research and development with PLA-TANK — first in the field, and still the leader.

WRITE TODAY — mentioning your requirements, for complete data sheets on new PLA-TANK material.

P-18



General Motors' Fifty Millionth Car



A portion of the more than 600 decorative trim parts which were gold-plated for the Golden Chevrolet, GM's 50,000,000th automobile. Such body parts as door handles, sun visor brackets, horn ring and Bel Air monograms are zinc die castings. Other zinc alloy parts, which make up a large part of the decorative trim components, include the hood and trunk lid emblems.

New Sales Office for Dow Chemical

Continuing to expand its sales organization, *The Dow Chemical Co.* announces the opening of a new field sales office in New Orleans to serve an area including Louisiana, the southern half of Mississippi, southwestern Alabama and northwestern Florida.

The office, located at 925 Common St., is under the direction of *Glenn H. O'Neal*, manager of the company's St. Louis, Mo. office.

This is the third field office opened by the company in the past 18 months, two others having been set up previously in Minneapolis and Cincinnati. The company now has 15 sales offices in major cities throughout the country.

An important feature of the New Orleans office is complete teletype service linking the office with all other Dow offices and manufacturing plants in the company's private line system, installed in 1946 to speed up transmission of orders and delivery of products.

The staff will include *Louis O. Litherland, Jr.*, specializing in general chemicals; *Richard F. Lee*, Dowflake;

Albert E. Weil, agricultural chemicals and *John J. Sheppard, Jr.*, office salesman for all products.

Vanton Moves Executive and Sales Offices

Vanton Pump & Equipment Corp., Empire State Bldg., New York City, announces the removal of its executive and sales offices to its plant location at 201 Sweetland Ave., Hillside, N. J. According to *George Black*, public relations counsel, this consolidation of management, sales and engineering activities is the result of expanded production and research facilities at Hillside and the stepped up program of product development both of which have demanded much closer liaison and communications.

Barrett Chemical Products Appoint Distributors

Coast to Coast distribution of the Barrett sulfamate nickel plating process has been announced by *Richard C. Barrett*, president of the *Barrett Chemical Products Co.* of Shelton, Conn.

Process Engineering Co. of 4918 Jarvis Ave., Skokie, Ill., who represents products in the electrotyping industry will also handle general plating distribution in Illinois, Michigan, Indiana, and Wisconsin.

R. O. Hull & Co. of 1300 Parsons Court, Rocky River, Ohio will serve Ohio, Western Pennsylvania, and Western New York states.

Alert Supply Co. of 4755 East 49th St., Los Angeles 58, Cal., with offices in Seattle, Wash., Portland, Ore., San Francisco and Los Angeles, Cal. will become West Coast distributors.

Austin F. Fletcher, Inc., Binghamton, N. Y. will distribute in Eastern New York state and in Northwestern Pennsylvania.

The Atlantic and New England states will continue to be served from the home office of the company in Shelton, Conn.

Erratum

In the January issue, on page 106, mention is made of the fact that *Ardco, Inc.* is now servicing Southern Illinois and Eastern Michigan for *Enthone, Inc.* The item should have read "Southern Illinois and Eastern Missouri."

New Automatic Plating Machine at Pontiac Features Selective Cells

The Udylite Corporation recently placed in operation at the Pontiac Motors plant a selective cell automatic plating machine which is the largest they have ever built—567 feet long, costing approximately four million dollars. A feature of the machine is the electrical circuits for the automatic operation which results in the use of very few operators. The Udylite Corporation was host to a group of editors recently when the installation was inspected.

In the conventional straight line automatic plating machine, the work carrier enters one end of the plating tank and travels between rows of anodes to emerge from the plating bath at the opposite end.

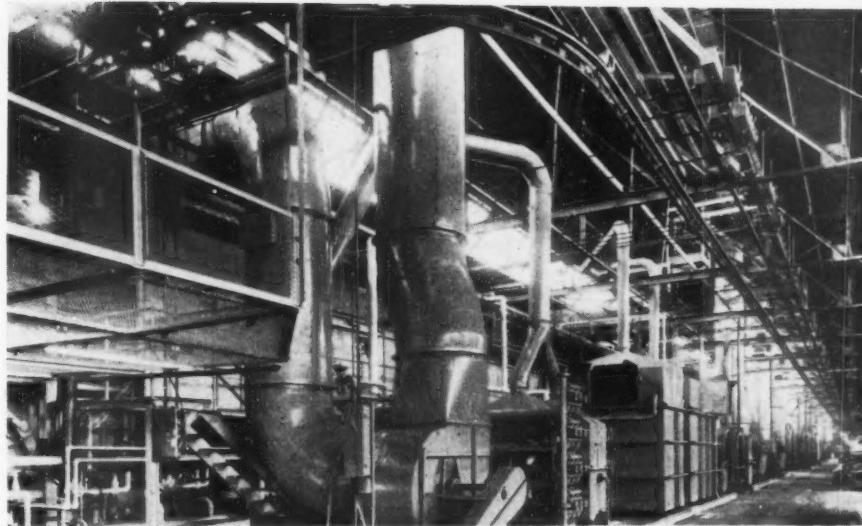
The above method was not desirable when curved parts such as bumper bars were encountered and the plater had been forced to use a "still" tank set-up where the parts were plated horizontally in nests or cells, and the plated parts moved by the overhead manually controlled electric hoists with the plater designating proper time intervals.

With the new machine the manufacturer introduces a method of rack handling which allows racks of parts to remain at rest in the "nest" of conforming anodes in the cells of the plating tank for the duration of the required plating time and during the plating time to provide for constant operation of tanks requiring less time, by selecting in sequence, empty cells in the plating section to accommodate the racks as they emerge from the proceeding operations.

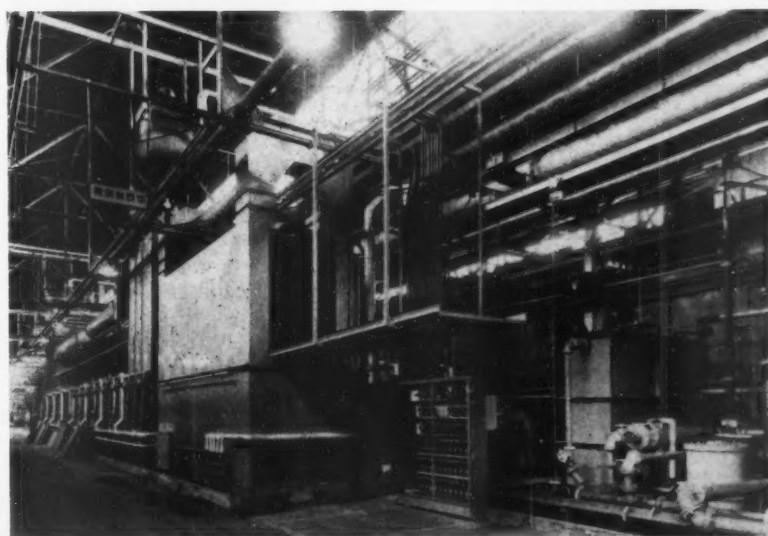
This machine with its unique method of operation is particularly well suited to larger parts requiring conforming anode arrangement.

This machine now in use is 460 feet long, 15 feet wide and 18 feet high. It operates on a 2 minute cycle to plate 30 racks of bumpers per hour. It was designed to handle the racks of 12 bumpers each to give an hourly production of 360 bumpers.

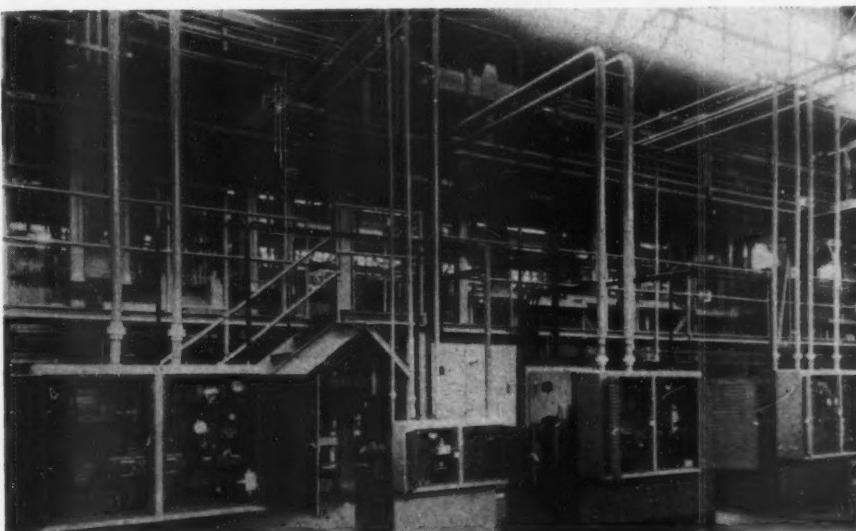
As indicated in the above description all electrified tanks are equipped with conforming anodes forming the "nests" into which the racks of bumpers are lowered for plating, etc. Also, on electrified tanks the cathode contacts are elevated to permit the work to enter the tanks "hot."



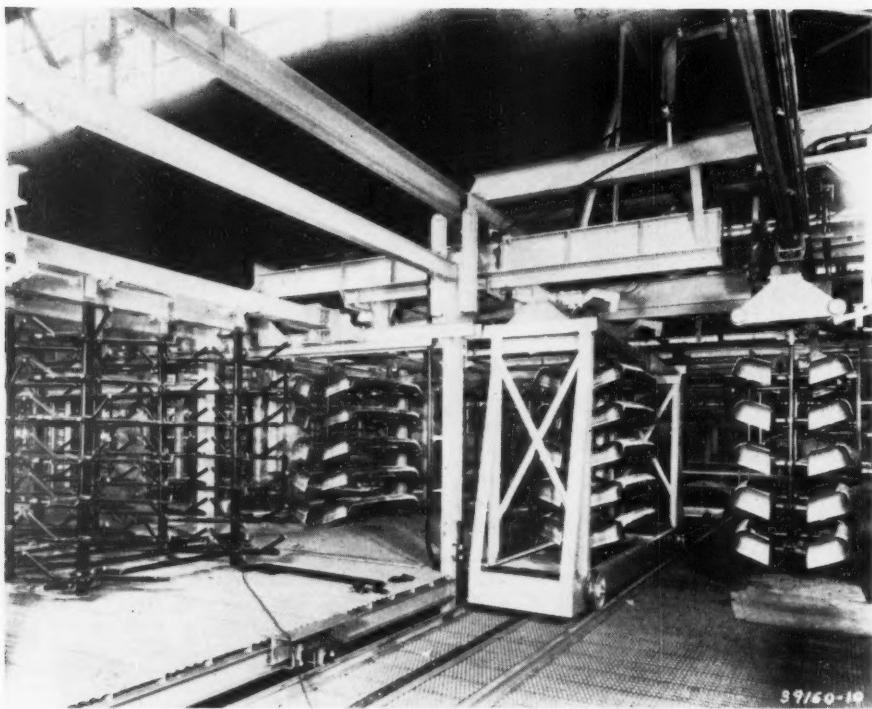
A general view of the aisle along the south side of the machine showing ventilating fan, heat exchangers, make-up tanks, generators, etc. The track of the conveyor is at the top of the machine.



North side of machine from the aisle. On the right are shown filters, heat exchangers and mixing tank. On the lower center, the control panel and left to center, rack strip tank and spray wash.



Vickers' hydraulic power drive units with control cabinets open. Three control valves in each cabinet regulate the speed of the machine.



Loading and unloading mechanism and shuttle car used to fill and empty rack storage area.

The work carriers are delivered to the machine by the conveyor device which crosses the first cell and at that point are transferred on to the full automatic mechanism.

The plating cycle is as follows:

1. Load and soak clean—3 station tank, rack moves in down position through the 1st cell.

2. Soak Clean—2 cell tank.
3. Warm water power spray — 1 cell, empty tank, constant spray.

4. Power wash — 3 cell empty tank, storage tank outside, 12' x 7' x 7' with 6 pumps, 3 in and 3 out, also 1 standby.

5. Cathodic Clean—3 cells, using 10,000 amps at 9 volts.

6. Cold Water Rinse—1 cell continuous circulation.

7. Drain and Transfer — 1 cell space.

8. Acid Dip—1 cell tank continuous circulation using 20 g.p.m. acid resistant pump.

9. Cold Water Rinse—1 cell tank.

10. Cyanide Dip—1 cell tank.

11. Cyanide Copper Strike—4 cell tank.

12. Recovery Rinse—1 cell.

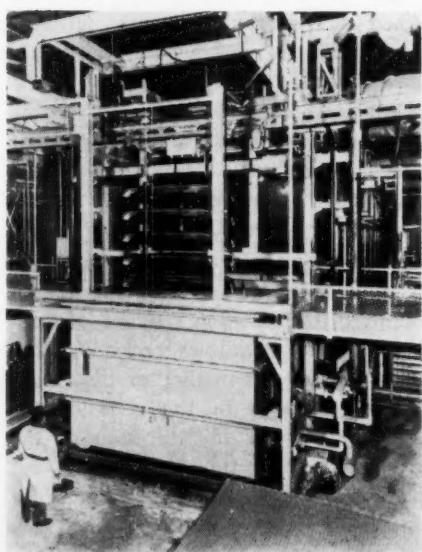
13. Cold Water Rinse—1 cell, continuous circulation.

14. Cold Water Rinse—1 cell, continuous circulation.

15. Acid Dip—1 cell tank, continuous circulation using 20 g.p.m. acid resistant pump.

16. Drain and Transfer—1 cell space.

17. Acid Copper—2-8 cell tanks,



A photograph taken from the upper level of the storage area of the loading end of the machine. The elevator is in the "up" position over the soak clean tank with the load of bumper bars ready to be lowered into it.

24,000 gallons each and 50' long each, air agitation, continuous circulation through heat exchangers—using 60,000 amperes at 6 volts.

18. Drain and Transfer — 1 cell space.

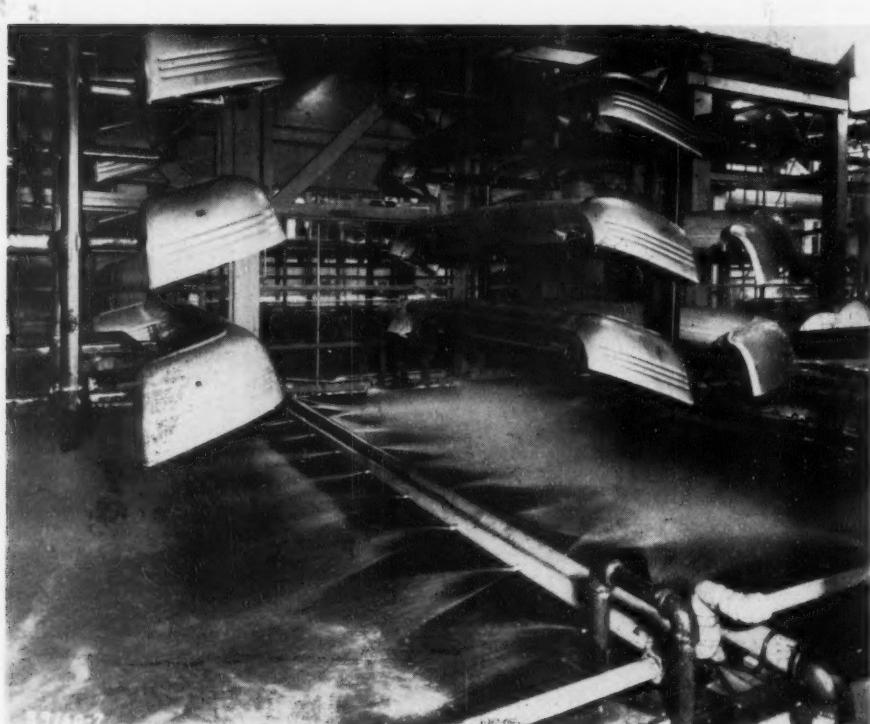
19. Recovery Rinse—1 cell tank, continuous circulation.

20. Cold Water Rinse—1 cell tank, continuous circulation.

21. Cold Water Rinse—1 cell tank, continuous circulation.

22. Nickel Strike — 1 cell tank, continuous circulation through heat exchangers, equipped with nickel purification.

23. Drain and Transfer — 1 cell space.



Racks of Bumper Bars over power spray wash in rinse section.

24. Nickel plate—2-8 cell tanks, 24,000 gallons each, using bright nickel processes, 50 feet long, continuous circulation through filters and heat exchangers with 2 electro-purification tanks, using 40,000 amperes at 9 volts.

25. Drain and Transfer — 1 cell space.

26. Recovery Rinse—1 cell tank.

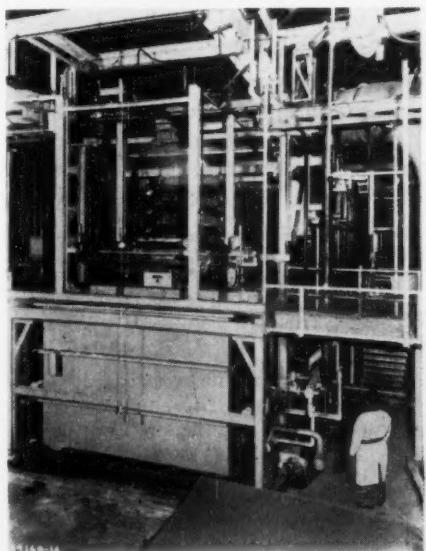
27. Cold Water Rinse—1 cell tank, continuous circulation.

28. Cold Water Rinse—1 cell tank, continuous circulation.

29. Acid Dip—1 cell tank, continuous circulation using 20 g.p.m. acid resistant pump.

30. Cold Water Rinse—1 cell tank, continuous circulation.

31. Warm Water Rinse — 1 cell tank, equipped with heating element.



A photograph taken from the upper level of the storage area of the loading end of the machine. The elevator is in the "down" position and has just delivered a work carrier into the soak clean tank.

32. Chromium Plate—2 cell tank. Continuous circulation through heat exchangers, 2 acid resistant pumps with 1 standby—using 20,000 amps, 12 volts.

33. Recovery Rinse—1 station.

34. Cold Water Rinse—1 cell tank, continuous circulation.

35. Cold Water Rinse—1 cell tank, continuous circulation.

36. Hot Water Rinse—1 cell tank with heating element air agitation.

37. Hot Air Blow off — 2 station tank, movement in down position with blower and air coils.

The racks coming through station 37 are picked up and transferred to



Work carrier in "down" or plating position in copper plating tank. Note pre-contact slides in background.

the conveyor system—the bumpers to go to the assembly line and the racks through the rack strip back to the rack storage area.

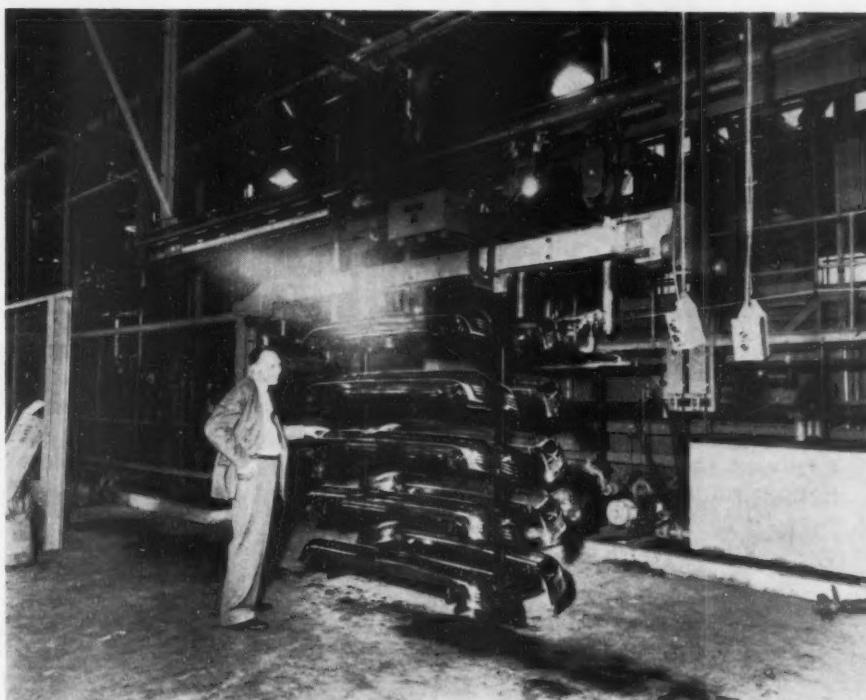
Rack Strip System

The racks are carried through on the conveyor. The carrier lowers into the rack strip tank and is carried through the strip by the tramrail car-

rier motor. The carrier is electrified and proceeds through 8 station strip tank. At the end it goes into an elevator where it is lifted out of strip tank and sent through the spray wash to the load station.

Duplex Deionizing System

Maximum production in gallons 7200 per hour.



Drop section at the left. Unloading area at center with a rack load of plated bumpers ready for the assembly line.

News from California

By Fred A. Herr



With the acquisition of the California Fabricating Co. at 4979 Branyon Ave., South Gate, by the California Rack Co., production of the latter firm has been augmented by a line

of stainless steel plating baskets.

Only an alley separates the plants so that integration of the two divisions represented no major problem for owner, *Howard Woodward*. The combined facilities provide him with 10,000 square feet of floor area for rack and basket design and production. California Rack Co. specializes in the design and fabrication of custom-made plating racks which are built to specification to meet the needs of all types of finishing problems. Woodward organized the firm five years ago. Prior to that he had been on the

sales staff of the Sundmark Supply Co. of Los Angeles.

Merit Products, Inc., manufacturers of abrasive wheels, has announced the appointment of *William G. Gillett* as manager of its Culver City, Calif., plant. He is in charge of production of Sand-O-Flex contour sanders and Grind-O-Flex flexible grinding wheels. Gillett was formerly affiliated with Ferguson Overhead Doors, Los Angeles, as superintendent of operations, and previously with Kimball Industrial Elevators.

William Ramsey has been appointed chief chemist for Virtue Bros. Mfg. Co. of Los Angeles, furniture producers and operators of an extensive metal finishing department. He formerly served as chief chemist for the Western Co. in East Alton, Ill.

Los Angeles Branch of the *American Electroplaters' Society* will hold its annual educational session and dinner dance at the Hotel Ambassador, 3400 Wilshire Blvd., Los Angeles, on Saturday, March 19. There will be

morning and afternoon technical sessions addressed by two local and two out-of-town speakers; a noon-day luncheon featured by the Branch's traditional Story-Telling Contest; and a banquet and ball in the evening, highlighted by the annual waltz contest. *George Hetz* is chairman of the arrangements committee.

"Problems of Industrial Chemical Management" was the title of the main address presented at the annual meeting of the Industrial Science Section, *American Association for the Advancement of Science*, held at Berkeley, Calif., on December 30. The speaker on that subject was *Francis J. Curtis*, vice-president of Monsanto Chemical Co. The annual gathering, held in conjunction with the 1954 convention and exposition of science and industry of the AAAS, was devoted to problems of basic research, with emphasis on the roles played by government, industry and universities in this activity. "The Role of Industry in Basic Research" was discussed by *Dr. Monroe E. Spaght*, executive vice-president, Shell Chemical Co.; and "The Role

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of the University in Basic Research" by Dr. Kenneth D. Pizier, dean of the University of California College of Chemistry.

A five-day course on corrosion was scheduled by the University of California at Los Angeles January 24 through the 28th in cooperation with the *National Association of Corrosion Engineers*. Purpose of the short course was to summarize current information and techniques employed in the control of corrosion. The course was concerned with the characteristics and mechanisms of corrosion and corrosion control. Included was discussion on design and equipment, chemical treatment of the environment, cathodic protection, and selection of coatings and alloys economically feasible for reducing corrosion losses. The course included special sessions on practical applications in specific fields, such as petroleum production and refining, water and power, and aircraft.

Following recent purchase by the George Getz Corp. of Chicago, Ill.,

of the physical assets of Fabriform Metal Products, Los Angeles, Kenneth L. Glick, formerly production manager, has been named general manager of the Los Angeles operations.

As an aftermath of the purchase of U. S. Spring & Bumper Co. of Los Angeles by Rheem Manufacturing Co., the Brake Division at Santa Clara, Calif., and the Chainveyor Division at Los Angeles were sold to a group of former U. S. Spring & Bumper Co. personnel, and now operate as separate corporations not under the Rheem banner.

Patrick Rauen, formerly vice-president of U. S. Spring & Bumper, heads both the Chainveyor Corp. and the Brake Division, known as Silver Line Brake Lining Corp. General offices for both firms are at 5618 East Washington Blvd., Los Angeles. Loren Working serves Chainveyor Corp. as vice-president, and Louis Long as plant superintendent. The Brake Corp., with factory in Santa Clara, is staffed with Art Smith as vice-president, Ames Arnold, assistant secretary, James

Rauen, general manager, and Roy Hall, plant manager and secretary.

Economic progress through nondestructive testing will be the theme of all technical sessions programmed by the *Society for Nondestructive Testing* as part of the Ninth Western Metal Congress, March 28 to April 1 in the Los Angeles Ambassador Hotel.

The programs for the entire five days of the SNT conference are being developed under the chairmanship of Maurice J. Curtis, head of the materials evaluation branch, U. S. Naval Ordnance Test Station, China Lake, Calif.

Other technical societies that will have programs at the Congress include the *American Society for Metals*, which also on March 28 to April 1 will hold the Western Metal Exposition in Los Angeles' Pan Pacific Auditorium; *American Welding Society*, *American Foundrymen's Society*, and the *Industrial Heating Equipment Association*.

Twenty-five technical societies are

COMING EVENTS of the A. E. S.

DAYTON BRANCH

Educational Session and Banquet

February 19

Dayton Biltmore Hotel

Dayton, Ohio

ROCKFORD BRANCH

Educational Session and Banquet

March 19

Hotel Faust

Rockford, Ill.

LOS ANGELES BRANCH

Educational Session and Banquet

March 19

Hotel Ambassador

Los Angeles, Calif.

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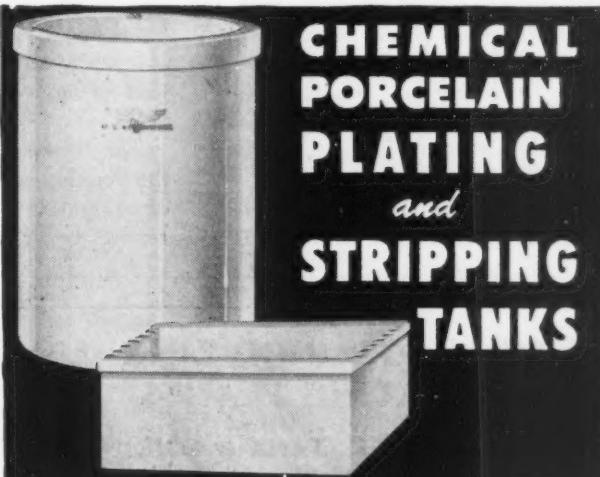
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Cleveland Public Auditorium

Cleveland, O.



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Associations and Societies

AMERICAN ELECTROPLATERS SOCIETY

1955 Industrial Finishing Exposition

The city of Cleveland will be the site of the 1955 Industrial Finishing Exposition. The show is to be held in the huge Cleveland Public Auditorium on June 20, 21, 22 and 23 in conjunction with the 42nd Annual Convention of the American Electroplaters' Society.

Widely publicized as the "best location in the nation," Cleveland is a fortunate choice for several reasons:

1. Sixty-three per cent of American Industry is located within a 500-mile radius and more than half of the 8,000 plating plants are within an overnight trip of the city.

2. The state of Ohio has over 1,500 plants employing more than 300,000 persons in various phases of industrial finishing.

Diversification is the keynote of the industrial finishing industry in Cleve-

land itself. Cleveland plants finish all kinds of equipment from small jet engine parts to huge parts for secret machinery. Included in this category are: electroplating, enameling, lacquering, vitreous or ceramic finishing, electropolishing, chemical finishing and anodizing.

It has been estimated that approximately 12,000 finishing plant personnel will attend the 1955 convention and show. A full round of activities has been planned for them.

Included in these activities are trips to various plating and finishing plants in the Cleveland area. Visits to both small and large job plating plants in addition to large "captive" plating plants are slated.

The convention affords terrific opportunities for the exchange of information so essential to the continued progress of the industry as a whole. The outlook for the plating industry is staggering. With the expected rise in population, and its accompanying increased buying power it will take a forward-looking industry to supply the market.

The companies that do not keep up with the times can not expect to maintain their share of new business. Organizations which are characterized by obsolete equipment, poorly planned plants and out-of-date information will find themselves in a precarious position.

The degree of importance given to the coming meeting by manufacturers of equipment is obvious from a recent report by Harold Bartlett of the

American Decorating Company, exposition managers of the 1955 show. The report states that more space has already been contracted than for any previous show held by the American Electroplaters' Society.

Pittsburgh Branch

The Pittsburgh Branch held its monthly meeting at the Sheraton Hotel's Avalon Room, Wednesday evening, December 1, 1954. A special steak dinner was provided by Mr. Ryan, Sheraton Caterer, for the customary dinner before the meeting.

We were pleased to welcome two new members into the branch, E. W. Shand, and D. F. Porter, and be host to 11 guests for the evening.

After the excellent dinner and short business meeting President Bob Vanner turned the meeting over to Librarian Fred Dixon. He introduced the speaker for the evening, D. B. Connelly from the General Engineering Lab. of General Electric Co. His subject for the evening was "Ultrasonic Cleaning."

The interest stimulated by Mr. Connelly's talk was evident by the very large turnout of members and guests and the long and lively discussion periods that were carried on during the talk and after the brief pause for refreshments. The talk covered the development, types of ultrasonic generators, commercial type units and applications, and limitations of this type of cleaning process.

During the brief pause for refreshments Mr. Connelly drew the name for the door prize. Bill Wilson was the lucky winner of an automatic electric skillet presented by Bud Weiss of United Chromium, Inc.

Herb Schram,
Secretary

Indianapolis Branch

Forty-one members and guests attended the December 1st, 1954 meeting at the Fox Steak House. Business meeting consisted of secretary's and treasurer's reports. Quentin Shockley, general chairman of annual dinner-dance reported that all plans are shaping up well and that he will have more to report at the January meeting. Herb Kennedy reported on the tri-state meeting at Columbus, Ohio in March.

Under new business the following were elected as delegates to the national convention: Abraham Max,

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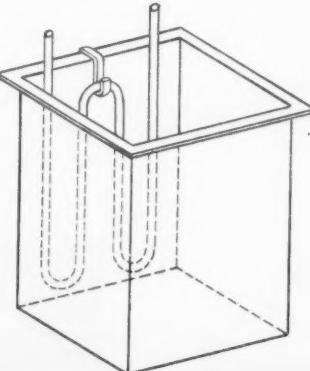
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Quentin Shockley and Edna Rohrbaugh. The alternates are *John Hood, Walter Gulleson and Bert Hawhee.*

Concerning a paper for the national magazine *Plating*, it was suggested by the committee that another one be prepared. Information was asked about rules and regulations for a display at the next national convention. The committee will have a report on this matter later.

The program was given by *John Swift* of Swift Chemical Co. who talked on "What a plater should know about metallurgy."

The meeting adjourned at 9:55 P. M.

*Edna Rohrbaugh,
Secretary*

Louisville Branch

The regular monthly meeting of the Louisville Branch was preceded by a dinner at Kapfhammer's Party House on November 18, 1954. Fifteen members and guests were present for the dinner.

The meeting was called to order by President *John Scholl* at 8:00 P. M. There were a total of 26 members and guests present. Secretary *Joseph Sterling* was absent, being out of the city, and Mr. Scholl asked *Stanley Beyer* to call the roll of officers and to read the minutes of the September and October meetings, and the report of the Treasurer. *Arthur Oertel* was then asked to take the minutes of this meeting.

The applications for membership were reported by Mr. Beyer, and were from the following:

Kenneth Buse, Louisville, Ky., Duke Scott, Louisville, Ky.; Melvin Matthews, Webster, Ky.

Application for transfer from the Richmond, Calif., Branch was received from *Charles H. Wirth*. A motion was made, seconded, and duly carried to admit these four gentlemen into our branch.

Mr. Scholl announced that a meeting of the Board of Managers would be held on the evening of December 9, at 7:30, at Cunningshams.

The speaker of the evening was introduced by Librarian *Stanley Beyer*. He was *Elmer Rehme*, of the United Chromium Corp. He spoke on the subject of "Hard Chrome Plating," presenting slides of charts and plated specimens showing comparative efficiency, hardness, and appearances of deposits made with conventional chrome

plating bath and the Self Regulating High Speed bath. A considerable interest was shown through questions by those present and Mr. Rehme was complimented for his able presentation.

The meeting was adjourned at 10:15 and refreshments were furnished through the courtesy of the United Chromium Corp.

*Arthur A. Oertel,
Acting Sec'y.*

Central Michigan Branch

The December meeting of the Central Michigan Branch was held at the Porter Hotel in Lansing on 12/14/54. After a dinner of roast turkey and dressing plus trimmings the meeting was called to order by the Branch President, *Fred Stuckenber*. Mr. Stuckenber turned the meeting over to *F. Young*, librarian, for introduction of the speaker *R. D. Link*, district rectifier specialist of the General Electric Co.

Mr. Link took as his subject for the evening a discussion of the merits of the germanium rectifier as compared to the copper oxide and selenium rectifiers more commonly used for plating. The speaker pointed out that the germanium rectifier, the latest development in D. C. power supply for plating operations, is considerably smaller for comparable output than either the selenium or copper oxide rectifiers.

At the present time for outputs of 25 volts, the germanium rectifier compares favorably in cost to a selenium rectifier. But at lower voltage requirements 6, 9 and 12 the cost of german-

ium over selenium is approximately 2 to 1.

The General Electric representatives also presented a film entitled "Clean Waters" which concerns the problem of pollution of the existing water supply. It was pointed out in the film that the solution to this problem is a more adequate system of sewage disposal plants throughout the nation.

A. Medwadoff, a visitor from the Saginaw Valley Branch, presented an interesting and entertaining series of colored slides of the parade in Flint, Mich., commemorating the building of the fifty millionth automobile by General Motors Corp.

*R. W. Boos,
Publicity*

Dayton Branch

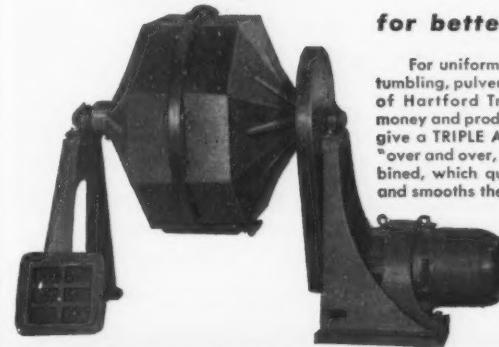
The Dayton Branch will hold its Tenth Annual Educational Session and Dinner Dance on Saturday, February 19, 1955 at the Dayton Biltmore Hotel.

Three outstanding papers will be given at the Educational Session starting at 1:30 P.M. *Clarence Van Derau*, general works manager, Westinghouse Electric, and past president of the A.E.S. Supreme Society will serve as honorary chairman. The speakers and their topics are:

1. *R. B. Saltonstall*, technical director, Udyline Corp., Detroit, Mich. Subject: Chemistry of Electroplating.

2. *A. M. Max*, Engineering Div., RCA Victor Corp., Indianapolis, Ind. Subject: Electroforming As Applied

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To The Manufacture Of Phonograph Records.

3. E. R. Bowerman, Physics Laboratories, Sylvania Electric Products Co., Flushing, N. Y. Subject: Soldering.

The Dinner Dance in the main ballroom will start at 6:30 P.M. Tickets are available at \$6.50 per plate. For tickets and reservations contact Jack Baker 5025 Lauderdale Dr., Dayton 9, Ohio.

Richard M. Clinehens,
Secretary

Chicago Branch

Chicago Branch enjoyed its usual monthly meeting at the Western Society of Engineers on January 14, 1954. Following the business meeting, and dinner, Dr. R. J. Rohr, of the Mitchell-Bradford Chemical Co., Stratford, Conn., addressed the group on the subject of "Black Oxide Finishing." In addition to his fine academic background, Dr. Rohr is well known to Chicago Branch members through his past association with the Great Lakes Plating Co. of Chicago. As a result of his experience and his intensive research into the metallurgy and metallography of oxide films on metal he handled his subject very capably. Due to the current interest in wrought iron, considerable interest was shown by the members and his talk was followed by a lively discussion period.

An announcement of the passing of one of the old timers on December 4th, after a prolonged illness, was cause for sadness. Ralph Leonard Shannon, who was born February 5, 1896, was

for many years an active member of the Chicago Branch.

Copies made from the transcribed proceedings of papers presented by speakers at the Annual Educational Session on Jan. 29th, are now available at a cost of \$1.00 per copy. These papers presented before the Chicago Branch should be worthwhile additions to any library and the nominal charge is actually less than the preparation charges. Copies are obtainable from the Secretary of the Chicago Branch.

It was announced that the Branch had contributed \$700 to the Illinois Institute of Technology. This fund is for the purchase of equipment to be used in teaching electroplating.

Jerome Kuderna,
Publicity Chairman

Rockford Branch

The Rockford Branch of the American Electroplaters' Society will hold its thirteenth Annual Educational Session and Banquet on March 19, 1955 at the Hotel Faust, in Rockford.

Cincinnati Branch

The meeting of the Cincinnati Branch on December 16 was one of the most enjoyable for some time. Ladies Night was combined with recognition of past presidents of this Branch. Seventy-one members and guests were present; of which total, thirty-three were of the fairer sex.

President Wm. Gordon took this occasion to alert the ladies to their responsibilities for the 1958 National Convention to be held in Cincinnati. Corsages of white carnations were pre-

sented to all of them — courtesy of Ezra Blount of Products Finishing. Mrs. Roger Slater was the lucky winner of the door prize — a sterling silver necklace and earring set.

Special invitations were issued to all past presidents of the local branch, and a great majority were able to attend. Those present represented a period in our history from 1934 to date. The following men were given past president pins, along with words of appreciation for their contribution to the club's growth.

Robert J. Knoepfle	1934-1942
Harry Misner	1942-1943
Wm. Ehlen	1944-1945
August S. Schwering	1946-1947
John F. Daymude	1947-1948
Ezra A. Blount	1950-1951
Robert D. Miller	1951-1952
	1952-1953

Carl H. Truman 1953-1954

The other past presidents — Bill Stoddard, Hank Nice, Bill Albohn and Fred Brune — were unable to attend, and letters were read expressing their regrets.

It should be mentioned that the history of the local branch goes back to early 1900's, but records do not disclose names of other presidents prior to 1934. It is entirely possible that we have overlooked some, and we would appreciate hearing from them if this be the case.

The speaker of the evening was Ollie James, columnist for the Cincinnati Enquirer. His endless supply of jokes and Herb Shriner style kept everyone laughing and in gay spirits. Not to be outdone, Mrs. Ezra Blount showed some color movies of her trip to Europe this last summer and led a lively and interesting discussion on highlights of the trip. A large and varied display of articles "picked up" on her tour were available for inspection. Members were given a chance to introduce the Mrs. during the Social Hour which terminated the occasion. Refreshments furnished by Products Finishing.

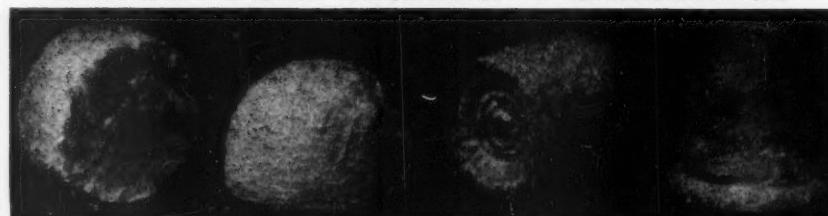
L. J. Howald,
Secretary

Buffalo Branch

On Friday, January 7, 1955, H. W. Couch of United Chromium Inc. discussed "Recent Development in Chromium Plating" covering the following subjects:

1. "Cold Chromium" plating baths for depositing chromium directly on aluminum.
2. "Crack-free Chromium."

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3. Fatigue properties of chromium plated steel. In this portion of the talk Mr. Couch pointed out that, in most cases using chromium plated high strength steels, the fatigue properties of the steel after chromium plating is less than without plating but, if the plated part is stress relieved (350°-375°F. for 1-4 hours), strength is still lower. Mr. Couch showed that deposits which are relatively crack free had a greater reduction of fatigue strength than deposits which had many fine cracks.

At the meeting on Friday evening, March 4, 1955, Howard McAleer of Formax Manufacturing Co., Detroit, Mich. will discuss "Polishing and Buffing Compounds and Wheels."

Place: Markeen Hotel — Main St. and Utica St.

Time: 8:00 P.M. — Dinner 6:00 P.M.

*Eric G. Sampson, Jr.,
Secretary*

Detroit Branch

The Annual Session of the Detroit Branch was held on Dec. 3, 1954, in the Statler Hotel. In attendance were approximately 200 members and guests. President Joe Gurski opened the meeting, designated as the National Officer's Night, at 8:30. He introduced P. Peter Kovatis, executive secretary of the A.E.S. and managing editor of *Plating* who told the members of the present status of our national publication. He also explained the present conditions of our Research projects and invited all members of the A.E.S. to see the improvements and modernization in our national headquarters.

Charles Conley, Houdaille-Hershey Corp., was the honorary chairman of the evening and he introduced the first guest speaker Dr. Ralph Schaefer, Clevite Brush Development Co. and national president of the A.E.S. who made some opening comments on the problems in the National Society.

The subject of Dr. Schaefer's talk was "A Qualitative Study of Macro and Micro Metal Distribution in Plating Baths." The talk covered qualitative data for macro and micro metal distribution. The data was obtained by the plating of cyanide copper and silver, chromium, nickel, stannate tin and electroless nickel on flat and formed cathodes with or without pores. Numerous slides were shown giving evidence of the conditions of micro



Pictured above are Messrs. Nixon, Conley, Schaefer, Candee, Pinner and Caldwell. Dr. Schaefer is President of the A.E.S. The others are Past Presidents.

and macro throwing power. It was shown that electroless nickel has good penetration qualities, and also that acid solutions penetrate better than cyanide baths. Studies were made of various nickel baths and slides shown indicated that the Watts bath had poorer penetration as compared to fluoroborate and sulfate type baths which appear to be the best.

Dr. George Dubpernell, United Chromium, Inc., was the second guest speaker and his talk was "Industrial Uses of Electroplating Processes." Slides were shown giving the plating solutions that have greater efficiency—

such as cadmium, gold, tin, zinc, etc. Other metals that are plated on the periodic chart worth mentioning are: Selenium, used recently on rectifiers; Polonium — black coatings; Germanium — rectifiers; Lead — hot dipping mostly; Indium — used on bearings. Numerous other metals were mentioned from the periodic chart that are more difficult to plate and have little or no commercial use. Dr. Dubpernell concluded that the field for electroplating could expand greatly, in an attempt to absorb the great amount of coating being done by an immersion process.

The meeting adjourned at 10:45

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On left is Dr. Ralph Schaefer, Clevite Brush Dev. Co., National President of A.E.S. At right is Joe Gurski, Ford Motor Co., President, Detroit Branch A.E.S.

P. M. after a question and answer period. Fellowship continued with the serving of refreshments.

On Saturday evening, December 4th, the Annual December Dinner-Dance was held at the Hotel Statler. General Chairman was T. Curtis McKenzie, Klem Chemicals. In attendance were over 1600 members and guests. An excellent program was planned with gifts for the women, dancing, refreshments and entertainment.

John C. Drinkwater,
Public Relations Chairman

Grand Rapids Branch

Over fifty members attended the December 10, 1954, dinner meeting of the Grand Rapids Branch. President Carl Green opened the meeting by introducing the guest, Warner Bloomenthal of the A.M.I. Co. of Grand Rapids.

Librarian, Tom Henner, introduced Dr. C. Fred Gurnham, head of the Chemical Engineering Department of Michigan State College. Dr. Gurnham presented a fine discussion on "Electroplating Waste Disposal." He cited five main sources of pollution, as follows:

(1) Natural pollution, (2) Agricultural, (3) Mining, (4) Municipal sewage, and (5) Industrial pollution. In a sense, any industry that uses water is a polluter. Dr. Gurnham said every means should be used to eliminate waste by cutting down on waste formation. Employees should be educated not to be careless or mechanical controls should be installed so mistakes cannot occur. Streams should be used as much as possible, but if streams or sewers cannot handle the waste, it must be treated. Dr. Gurnham said it is best to treat each waste at its source, as it is too difficult to treat different wastes after they have been mixed. Cyanide wastes are best destroyed by chlorination.

Following Dr. Gurnham's talk, a movie made by General Electric Co. entitled *Clear Waters*, was shown. The movie brought forth the facts that 6,700 new sewage disposal plants are needed in this country and pollution is costing us over \$200,000,000 a year.

Kenneth Hampel,
Publicity Chairman

Los Angeles

An excellent talk on the importance of using high quality water for plating operations was presented at the January 12th meeting of Los Angeles Branch by James E. Burton of Los Angeles, director of the West Coast laboratory of the Culligan Corp.

In his discussion on the subject, "Demineralization of Water," with emphasis on applications for the plating room, Mr. Burton outlined the advantages and disadvantages involved in six different methods of providing a plating plant with water.

Mr. Burton discussed such phases of demineralization as ion exchange and ion exchange material, cation and anion exchange material. He described what takes place during the hydrogen state, the hydroxide state and demineralization, and outlined the regeneration process involved in duo-bed and uni-bed systems. In order that his audience might more closely follow his commentary, the speaker distributed engineering drawings of various demineralization systems.

President G. Stuart Krentel initiated five new members during the business session which was called to order at 8 o'clock with 90 members and guests present. The new members are Kenneth Baum, Harshaw Chemical Co.; Joseph LaVoy, Peterson Plating

Co.; Al Castellero, L. H. Butcher Co.; Robert Pooler, Harvey Aluminums, Inc.; and Lester Daniels.

A nominating committee composed of Don Bedwell, Earl Coffin and Walter Behlendorf, all past-presidents, will draw up a slate of candidates for branch offices which will be submitted for voting at the February 9 meeting. In a departure from previous nominating procedure, members this year may suggest nominees by submitting names in writing together with a summary of qualifications of their candidates.

N.F.M.F. - N.A.M.F.

Merger Plans Announced

Recent discussions by the Boards of Directors of the National Association of Metal Finishers and the Federation have resulted in concerted activity directed at a merger of the two national organizations. The intention is outlined in a joint resolution passed by the two groups.

According to the resolution, the two Boards "... recognize the need for a united national association to represent the interests of the job shop metal finishing industry in the United States, and . . . resolve to effect a merger of the two organizations . . ."

The resolution states further that committees of equal number will meet, with the power "... to negotiate all details necessary to the attainment of this stated goal . . ." It is expected that formal meetings of the committees will be held within a few weeks, anticipating completion of a merger by mid-summer.

Discussion of the necessary alterations in the respective Constitutions of the two national groups has already begun in the committees of both organizations. The Federation representatives, J. R. Greenwell, L. J. Hay,

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Frank Kaiser, and Al D'Agostino, have all met with their own local association committees on Federation affairs, and with each other on the first procedures in the merger discussion.

National Association of Corrosion Engineers

Fundamentals of corrosion are to be stressed rather than consideration of solutions to specific practical problems during the three-day University of Tennessee Corrosion Conference scheduled to be held March 1-3, 1955.

Subjects included will be catastrophic corrosion, liquid and metal corrosion, use of plastics and plastic liners for corrosion protection, principles of cathodic corrosion, passivation of stainless steels and nature of metals and alloys. Four simultaneous round tables are planned on corrosion control practice on atmospheric corrosion, high temperature corrosion, corrosion by chemical solutions and underground corrosion.

NEW BOOKS

Electroplating Engineering Handbook

By Dr. A. Kenneth Graham. Available from our book department, 1955. \$10.00. 650 pages.

The metal finisher can now find any pertinent information he needs without having to thumb through a dozen handbooks or references. Prepared by a group of authorities, under the direction of one of the most prominent consultants in the field, the first handbook to be published on the subject combines the best parts of a textbook, operating manual, chemical dictionary, and book of tables.

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technical literature, from which the user must choose the most suitable process of the many reported. Only practical, commercial procedures are described and the subjects range from design, through operation, control, and maintenance of the polishing and plating department, profusely illustrated and replete with tabular data.

The chapter on plating barrels is the most complete compilation of information ever published on construction, use, and department layout, even including chromium plating. Other subjects such as cost estimating, standards and specifications, continuous plating of strip and wire, barrel finishing large and precision type castings, trouble shooting, racks, and racking, are treated with thoroughness as yet unduplicated.

Whether the problem is a bright dip for zirconium or construction of an efficient rinse tank, the answer to practically all questions will be found in this handbook. It is a reference not only for the finishing foreman but for the chemist, metallurgist, engineer, plumber, electrician, maintenance man and inspector.

Electrometric pH Determinations

By Roger G. Bates. Published by John Wiley & Sons, Inc., 440 - 4th Ave., New York 16, N. Y. 1954. Price: \$7.50. 331 pages, including index.

Every aspect of the subject is surveyed by the author, from both the theoretical standpoint and the practical applications. Described are the assumptions on which this method of determining acidity is based, establishment of standards, preparation of buffer solutions, construction of cells, electrodes and meters, and their care. Specialized applications are not included but the book does cover the equipment and methods of automatic control systems, using modern commercial apparatus.

The user of an electronic pH instrument will find this book a very helpful discussion of its limitations, advantages and proper use and maintenance.

Engineering Metallurgy

By Dr. E. M. H. Lips. Distributed by Elsevier Press Inc., 155 E. 82nd St., New York 28, N. Y. 1954. Price: \$6.25. 247 pages.

With the help of 170 illustrations and 56 tables, the author sets out a great volume of technical information,

both on the characteristics of the commercially used metals and alloys and on their heat-treatment. Except for a chapter on the corrosion of metals, this book will be of interest mainly to the metallurgist and fabricator who need to know the precise qualities of the new materials as well as of the old.

OBITUARIES

HARRY O. SCHUESSLER

Harry O. Schuessler, 60, vice-president, general manager and part owner of Apollo Metal Works, Chicago, Ill., and Bethlehem, Penna., died suddenly December 22, 1954. His demise followed an illness of short duration. Interment took place Dec. 24. Private rites were conducted in the Chicago suburb of Western Springs where the Schuesslers resided.

Mr. Schuessler had been associated with Apollo Metal Works since the company was founded by his father forty years ago. He was born Jan. 21, 1894 in Amityville, Town of Babylon, Suffolk County, N. Y. Surviving him are his widow, Ada, and three sisters.

RALPH LEONARD SHANNON

Ralph Leonard Shannon passed away on December 4th, after a prolonged illness. Born February 5, 1896, he was for many years an active member of the Chicago Branch and was associated with the Diversey Corp. from October 18, 1943 until his death. Since October 1, 1949 he had served as promotional manager of their Metal Industries Department. During World War I he served in the Air Corps. He is survived by his wife, two married daughters and seven grandchildren.

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Manufacturers' Literature

Copper Alloy Specifications

The American Brass Co., Dept. MF,
Waterbury 20, Conn.

A tabbed, easy-to-use, 24-page reference manual, B-34R, contains the latest copper and copper-alloy specifications. Included in this completely revised edition are ASTM, ASME, AWS, SAE, AMS, Federal, Military, Army, Navy, and Joint Army-Navy specifications. The new index is divided into two sections. The first is a list of the most generally used alloys made by the company, together with the applicable specifications of the agencies. The second section lists specifications in numeric order with a brief description of the material as to alloy, grade, type, temper, anneal, etc.

Metal Cleaning

Metalwash Machinery Corp., Dept. MF, 901 North Ave., Elizabeth 4, N. J.

A free 12-page illustrated booklet "What You Should Know About Metal Cleaning" is offered with an introduction on the fundamentals of metal cleaning. The booklet discusses types of cleaners, washing cycle, cleaning prior to plating, cleaning prior to painting, pickling prior to enameling, pickling between drawing operations, and the application of metal parts processing machinery to the metal-working industry.

Metal Strippers

Enthone, Inc., Dept. MF, 442 Elm St., New Haven, Conn.

A new four-page illustrated folder is available which describes the company's Enstrips. These are materials for selective stripping of one metal from another, for example, nickel from steel or copper, tin or tin-lead from copper or steel, and copper from steel. A handy chart is given to enable easy selection of the proper stripper for any particular job.

Polyethylene Fabrications

American Agile Corp., Dept. MF, P. O. Box 168, Bedford, O.

A six-page report, illustrating and describing important applications for large plastic structures in feature article form, points out that polyethylene, originally developed as a dielectric, is now bidding for structural applications in welded units, primarily where lightness in weight and corrosion resistance are decisive factors. Advantages of the material include its relatively high softening point and good mechanical properties; its outstanding resistance to a broad range of chemicals; its superior electrical insulating properties; and its ability to be fabricated by welding, injection molding, blow-molding, extrusion, and centrifugal casting.

Typical fabrications are illustrated together with photos of plastic welding operations. Engineering tables and drawings are likewise included.

Barrel Finishing Techniques

Minnesota Mining and Mfg. Co., Dept. MF, 900 Fauquier St., St. Paul 6, Minn.

Two new booklets describe barrel finishing techniques and products. One of the publications, "Barrel Finishing," explains how barrel finishing works, what types of parts can be barrel finished, and what operations barrel finishing performs. It contains an illustrated case history section pointing out how manufacturers of many types of parts are increasing production and cutting unit costs by barrel finishing; and it lists materials needed for the process. The booklet also lists the complete line of Honite chips, compounds and equipment; and features step-by-step pictures of barrel finishing operations.

The other booklet, "Abrasive Chips and Compounds for Barrel Finishing," describes in detail the differences between Honite and Super Honite barrel finishing chips, and gives specifications for the 11 Honite compounds available for cutting, finishing and cleansing operations.

Barrel Plating

Platers Research Corp., Dept. MF, 59 East Fourth St., New York 3, N. Y.

Ten modern methods of handling and cleaning small parts before barrel plating are contained in a table of a new brochure, offered free of charge by the above manufacturers of Nickelite barrel nickel brightener.

The brochure also describes various modern formulas for the make-up of bright nickel barrel plating solutions and describes how corrosion resistance may be improved without increasing plating time.

Included in the folder in a handy reference guide on thicknesses of deposits obtained under average plating conditions from nickel, cadmium, brass, silver, tin and zinc barrel solutions.

Armored Motors

General Electric Co., Dept. MF, Schenectady 5, N. Y.

A new full-color, four-page, publication describing armored motors (direct current types MD and MDP, 600 series) is designated GEA-4654C. The bulletin provides information on performance and maintenance features of the heavy-duty G-E motors. Included in the bulletin are horsepower ratings



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and mechanical data. Diagrams and photographs illustrate various applications of the armored motors in the steel, lumber, oil, and construction industries.

Power Supply Bulletin

Perkin Engineering Corp., Dept. MF, 345 Kansas St., El Segundo, Cal.

The publication of a new technical periodical entitled the "Perkin Power Supply Bulletin" was recently announced. This bulletin will include technical characteristics and articles concerning the latest advances in the fields of magnetic amplifiers and power supplies. It will also contain humorous anecdotes concerning the engineering field. Subscription is available on a no charge basis by writing on letterhead to the above company. The first issue which is now available contains articles on: "Airborne Radar Power Supplies," "Analysis of A.C. to D.C. Conversion Methods," "Comparison of Magnetic versus Electronic Regulation," etc.

Abrasives and Polishing

The Carborundum Co., Dept. MF, Niagara Falls, N. Y.

The above company has just published a new booklet "Abrasive Grain and Powders" for use in metal finishing. Packed with informative charts and illustrations, the booklet contains many of the firm's latest abrasive engineering recommendations. Topics include "Properties of abrasive grain and powders," "Elements of metal polishing," "Preparation and care of polishing wheels," and "General rules for good polishing." The 42 page booklet contains a suggested layout for set-up room and curing room and devotes a chapter each to metal buffing, metal tumbling, and pressure blasting.

Barrel Finishing

Tumb-L-Matic, Inc., Dept. MF, 4510 Bullard Ave., New York 70, N. Y.

The above manufacturers of tumbling barrels and compounds for finishing metal and plastic parts and other materials, offers a new bulletin entitled "Tumb-L-Matic Processes and Compounds for Tumbling Metal and Plastic Parts."

The bulletin describes wet & dry, and combination processes. It gives barrel-type, compound and media specifications for cutting, defining,

smoothing, polishing, lustering and other operations. Information is in easy-to-read chart form. Copies may be obtained by requesting Bulletin P-55 from the manufacturer.

Rubber Linings

Protective Coatings Div., Metal-weld, Inc., Dept. MF, Scotts Lane & Abbottsford Ave., Philadelphia 29, Pa.

An illustrated, two-color, 8-page bulletin describes the advantages and application of rubber lining to steel tanks, drums, pipes, valves, fittings and pumps. Included in the bulletin are important tables giving the resistance characteristics of MW rubber lining to inorganic acids, salts and alkalies, organic materials and a wide group of miscellaneous materials. Details on the chemical, abrasive and temperature resistant qualities of rubber linings and the different types of linings available are also given. The company's plant facilities for cementing, lining, and vulcanizing all types and sizes of equipment are illustrated, and the bonding process which joins rubber and steel together with a bond strength of over 500 psi, is described.

Thanks for Your Christmas Cards! !

We acknowledge with sincere thanks the kind thoughts expressed in the Christmas cards received from the following:

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- 1—Chandeysson Electric 600/300 ampere, 6/12 volt, 1140 RPM self excited. Ser. #12300.

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500/250	6/12	Elec. Prod.
635	55	Elec. Prod.
640	39	West.
750/375	6/12	Excel
940	32	Elec. Prod.
1000/500	6/12	H-V-W
1500	65	G. E.
1500	70	Century
2000/1000	6/12	H-V-W
2000/1000	6/12	Chandeysson
2500/1250	6/12	Elec. Prod.
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- 1—5000/2500 Amp., 8/12 V., Chandeysson, 25° C., Synch., Exc.-in-head.
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- 1—3000/1500 Ampere, 6/12 Volt, Columbia, Synchronous.
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- 1—1000/500 Amp., 6/12 V., Electric Prod.

— ANODIZERS —

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- 1—1000 Amp., 40 V., Chandeysson, 25°C.
- 1—1000 Amp., 30 V., Ideal, Exc.-in-head.
- 1—750 Amp., 60 V., H-VW-M. Synch., Exc.-in-head.
- 1—500 Amp., 25 V., Chandeysson, Synch., Exc.-in-head.
- 1—400 Amp., 40 V., M. G. C., Exc.-in-head.

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- 1—Acme L-4 Semi-Automatic Buffing Machine.
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- 1—1500 A HVW 6/12 V.
- 1—800 A HVW 6/12 V.
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- 1—500 A Chandey. 12 V.
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- 1—200 A Boissier 6 V.
- 1—200 A U.S. 12 V.
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- 3—125 A Hobart 6 V.
- 1—120 A Eager 7½/15 V.
- 1—100 A HVW 6 V.

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- 1—1000 A G.E. 15 V.
- 4—25 A Dichi 25 V.
- 2—100 A G.E. 28 V.
- 1—200 A West. 28 V.
- 1—500 A G.E. 28 V.
- 1—800 A G.E. 28 V.
- 1—1500 A Cent. 28 V.
- 1—2500 A Cent. 28 V.

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- 1—200 A West. 32 V.
- 1—1000 A Cent. 32 V.
- 1—1000 A Chandey. 40 V.
- 1—1250 A Cent. 45 V.
- 1—75 A G.E. 50 V.
- 1—325 A West. 50 V.
- 1—1500 A G.E. 50 V.
- 1—1000 A G.E. 60 V.
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Motor Generators — Hanson-Van Winkle-Munning — like new.

- 1—9V, 3000 Amps. DC 50 HP Synchronous Motor, 600 RPM Power Factor 1, 440 V, 3 phase, 60 cycles.
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 - C. Acid Dip
 - D. Acid Rinse
 - E. Double Plating Tank Lined
 - F. Cold Water Rinse
 - G. Hot Water
 - H. Loading and Unloading Stand
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Pedestal-type polishing heads and automatic chrome plating machine with at least 52-inch lift.

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- 1—Bennett O'Connell 5000 amp.
- 1—Hobart, outside ex. 500 amp.
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- 2—U. S. Direct Drive, 7½ H.P.
- 1—Hammond 5 H.P.
- 10—U. S. variable speed 5 H.P.
- 1—Gardner 5 H.P.
- 1—L'Hommedieu 5 H.P. variable speed
- 2—Pesco 3 H.P.
- 5—Pesco 5 H.P.
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- 1—Alsop S.S. 7" 30 discs
- 1—Alsop S.S. 11" 20 discs
- 1—Alsop S.S. 7" 20 discs
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- 1—Industrial, rubber lined 10" x 28"
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- 1—Industrial, steel 10" x 22"
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- 1—Placo S.S. self priming 300 G.P.H.
- 1—Placo S.S. self priming 750 G.P.H., cyanide
- 1—Liquid Equip. with slurry tank, rubber lined

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- 3—6" x 12" Placo Utility
- 1—Reliance 8" x 18"
- 1—NuWhite 14" x 30"
- 1—Udylite, Double 14" x 30"
- 1—Udylite 14" x 30"
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- 1—Udylite Jr.

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- 1—Rubber Lined 6' x 40" x 30"
- 10—Chrome Tanks w/ducts 4-7'
- Over 150 other Tanks, assorted sizes.

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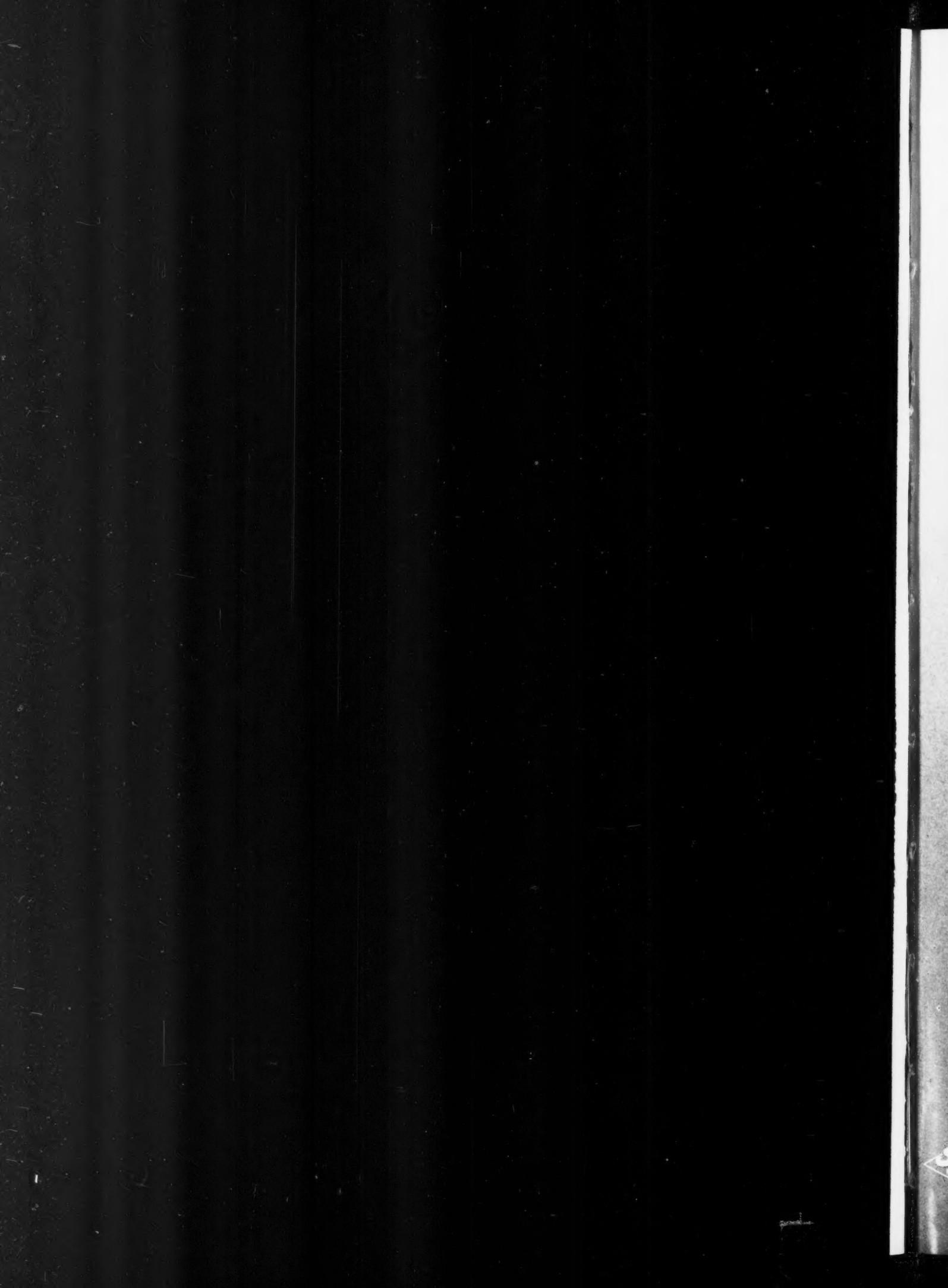
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42nd ANNUAL A.E.S. CONVENTION AND 4th INDUSTRIAL FINISHING EXPOSITION CLEVELAND MUNICIPAL AUDITORIUM JUNE 20-23, 1955

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Alert Supply Co.	118	Formax Manufacturing Co.	82	Mutual Chemical Co. of America
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Albert Lea, Minn.		Schenectady 5, N. Y.		60 E. 42nd St., New York 17, N. Y.
Alsop Engineering Corp.	92	Gumm Chemical Co., Inc., Frederick		Nobles Engineering & Mfg. Co.
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28 Benedict St., Waterbury 20, Conn.		538-542 Forest St., Kearny, N. J.		9310 Widener Bldg., Philadelphia 7, Pa.
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Beam Knodel Co.		Industrial Filter & Pump Mfg. Co.	81	Midland, Mich.
195 Lafayette St., New York 12, N. Y.		5906 Ogden Ave., Chicago 55, Ill.		Sarco Co., Inc.
Belke Manufacturing Co.	17, 103	Infilco, Inc.		350 Fifth Ave., New York 1, N. Y.
947 N. Cicero Ave., Chicago 51, Ill.		P. O. Box 5033, Tucson, Ariz.		Schaffner Mfg. Co.
Belmont Smelting & Refining Works, Inc.	46	International Chemical Co. Inc.	111	Schoffner Center, Emsworth, Pittsburgh 2, Pa.
304 Belmont Ave., Brooklyn 7, N. Y.		2628 N. Mascher St., Philadelphia 33, Pa.		Schori Process Div., FerroCo Corp.
Better Finishes & Coatings, Inc.	94	International Nickel Company, Inc.	109	8-11 43rd Road, Long Island City 1, N. Y.
268 Doremus Ave., Newark 5, N. J.		67 Wall St., New York 5, N. Y.		Sel Rex Precious Metals, Inc. Inside Back Cover
Blakeslee & Co., G. S.	7	Jelco Products	112	229 Main St., Belleville 9, N. J.
Chicago 50, Ill.		153 E. 26th St., New York 10, N. Y.		Sellers Engineering Co.
Block & Co., Wesley		Joe-D Buff Co.	24	4876 N. Clark St., Chicago, Ill.
116-15 15th Ave., College Point, L. I., N. Y.		Sandwich, Ill.		Sethco Mfg. Co.
Brucar Equipment & Supply Co.	129	Kalamazoo Tank & Silo Co.		78 Willoughby St., Brooklyn, N. Y.
Box 433, Hempstead, L. I., N. Y.		508 Harrison St., Kalamazoo 16, Mich.		Siefen Co., J. J.
Buckeye Products Co.	99	Kocour Company	36, 95	5657 Lauderdale, Detroit 9, Mich.
7020 Vine St., Cincinnati 16, Ohio		4802 S. St. Louis Ave., Chicago 32, Ill.		Simonds Abrasive Co.
Buckingham Products Co.		Kosmos Electro-Finishing Research	107	Philadelphia 37, Penna.
14100 Fullerton Ave., Detroit 27, Mich.		13 Valley St., Belleville 9, N. J.		Smoothex, Inc.
Central Machine Works	93	Kushner, Joseph B.	125	10705 Brigg Rd., Cleveland 11, Ohio
72 Commercial St., Worcester, Mass.		Stroudsburg, Pa.		Sommers Bros. Mfg. Co.
Chandeyson Electric Co.	12, 13	Lancy Laboratory	118	3439 No. Broadway, St. Louis 7, Mo.
4084 Bingham Ave., St. Louis, Mo.		533 Wampum Ave., Ellwood City, Pa.		Sparkler Mfg. Co.
Chemical Corp., The	114	Land, Inc., L. J.	129	Mundelein, Ill.
54 Waltham Ave., Springfield, Mass.		146-148 Grand St., New York 13, N. Y.		Stevens, Inc., Frederic B. 23, 102, 107, 108, 118
Churchill Co., Inc., Geo. R.		Lasalco, Inc.		Detroit 16, Mich.
75 Fayette St., Hingham, Mass.		2818-38 Lasalle St., St. Louis 4, Mo.		Stokes Machine Co., F. J.
Circo Equipment Co.		Lea Mfg. Co.	50	5500 Tabor Rd., Philadelphia 20, Pa.
120 Central Ave., Clark Twp. (Rahway), N. J.		16 Cherry Ave., Waterbury 86, Conn.		Storts Welding Co., Inc.
Clair Manufacturing Co.	112	Lea-Michigan, Inc.	108	42 Stone St., Meriden, Conn.
Olean, N. Y.		14066 Stanbury Ave., Detroit 27, Mich.		Stutz Mfg. Co., Geo. A.
Cleveland Process Co.	38	Lea-Ronal, Inc.	21	1643 Carroll Ave., Chicago 12, Ill.
1965 East 57th St., Cleveland 3, Ohio		237 E. Aurora St., Waterbury 20, Conn.		Sulphur Products Co., Inc.
Clinton Supply Co.	40, 128	L'Hommedieu & Sons Co., Chas. F.	5	Greensburg 7, Pa.
112 S. Clinton St., Chicago 6, Ill.		4521 Ogden Ave., Chicago, Ill.		Swift Industrial Chemical Co.
Codman Co., F. L. & J. C.		MacDermid, Incorporated		Canton, Conn.
694 Plain St., Rockland, Mass.		Back Cover		Tamms Industries, Inc.
Cohn Mfg. Co., Inc., Sigurd		Waterbury 88, Conn.		228 N. LaSalle St., Chicago 1, Ill.
121 S. Columbus Ave., Mt. Vernon, N. Y.		Magnus Chemical Co.		Technic, Inc.
Cowles Chemical Co.		11 South Ave., Garwood, N. J.		39 Snow St., Providence, R. I.
7016 Euclid Ave., Cleveland 3, Ohio		Magnuson Products, Inc.	123	Thermo-Panel Div., Dean Products, Inc.
Crown Chemical & Engineering Co.		50 Court St., Brooklyn 2, N. Y.		1042 Dean St., Brooklyn 38, N. Y.
4722 Worth St., Los Angeles 53, Calif.		Manhattan Rubber Div.		True-Brite Chemical Products
Crown Rheostat & Supply Co.	27	6 Willett St., Passaic, N. J.		P. O. Box 31, Oakville, Conn.
3465 N. Kimball Ave., Chicago 18, Ill.		McGeen Chemical Co.		Udylite Corp., The
Davies Supply & Mfg. Co.	111	101 Prospect Ave., N.W., Cleveland 15, Ohio		Detroit 11, Mich.
4160 Meramec St., St. Louis 16, Mo.		Meeker Co., The	84	Unit Process Assemblies, Inc.
Davis-K Products Co.	34	1635 So. 55th Ave., Chicago 50, Ill.		75 East 4th St., New York, N. Y.
135 W. 29 St., New York, N. Y.		Metal Finishing Mfg. Corp.		United Chromium, Inc.
Deming Co., The	88	89 No. 11th St., Brooklyn 11, N. Y.		100 East 42nd St., New York 17, N. Y.
567 Broadway, Salem, Ohio		Metal & Thermit Corp.		U. S. Galvanizing & Plating Equipment Corp.
Detrex Corp.	80	100 E. 42nd St., New York 17, N. Y.		31 Hayward St., Brooklyn, N. Y.
Box 501, Roosevelt Pk. Annex, Detroit 32, Mich.		Michigan Buff Co.	129	U. S. Stoneware Co.
Diamond Alkali Co.		3505 Gaylord Ave., Detroit 12, Mich.		Talmadge 9, Ohio
300 Union Commerce Bldg., Cleveland 14, Ohio		Michigan Chrome & Chemical Co.	32	Van Dorn Iron Works Co.
Dixon Ripple, Inc.	102	8613 Grinnell Ave., Detroit 13, Mich.		2691 E. 79th St., Cleveland 4, Ohio
Kingston, N. Y.		Mido Products		Wagner Bros., Inc.
Dow Chemical Company, The	16	1801 Borden Ave., Torrance, Calif.		418 Midland, Detroit 3, Mich.
Midland, Michigan		Minnesota Mining & Mfg. Co.	37	Walker Div., Norma Hoffman Bearings Corp.
Du Pont de Nemours & Co., E. I.	14, 41	900 Faquier Ave., St. Paul 6, Minn.		Stamford, Conn.
Wilmington, Del.		Mitchell Bradford Chemical Co.		Wallace & Tiernan Co., Inc.
Edmont Mfg. Co.		2446C Main St., Stratford, Conn.		25 Main St., Belleville 9, N. J.
1276 Walnut St., Coshocton, Ohio		Motor Repair & Mfg. Co., The		Worklon, Inc.
Electro-Glo Co.	126	1555 Hamilton Ave., Cleveland 14, Ohio		253 W. 28th St., New York 1, N. Y.
1430 S. Talman Ave., Chicago 8, Ill.		Munning & Munning, Inc.	128	Wyandotte Chemical Corp.
Electronic Rectifiers, Inc.	110	202-208 Emmet St., Newark, N. J.		Wyandotte, Mich.
2102 Spaam St., Indianapolis 3, Ind.				Zelite Corp.
Enthonie, Inc.	3			92 Grove St., Worcester 2, Mass.
442 Elm St., New Haven, Conn.				





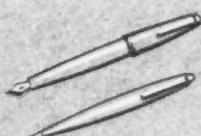
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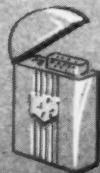
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